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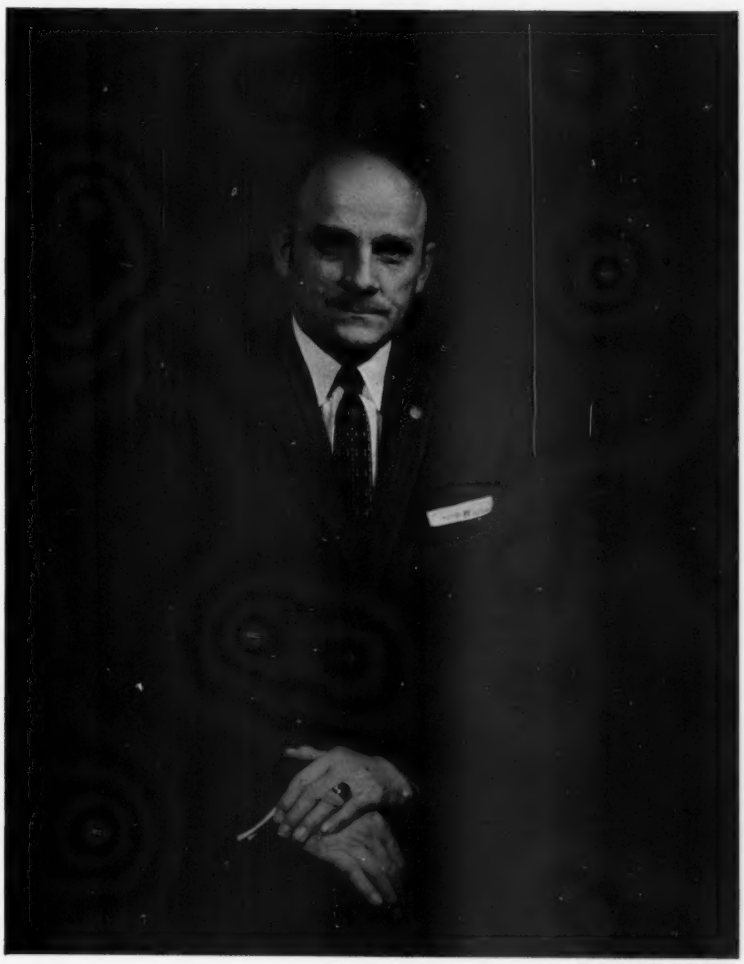

Photo by Fabian Bachrach

June 1960

HUESTON M. SMITH, president of Smith-Hanlon-Zurheide-Levy, Inc., consulting engineers – the new president of Consulting Engineers Council – was born December 19, 1912 near Almeda, Texas. He, even more than most Americans of that vintage, was profoundly affected by the two great disasters of the century – war and depression.

Continued on Page 10

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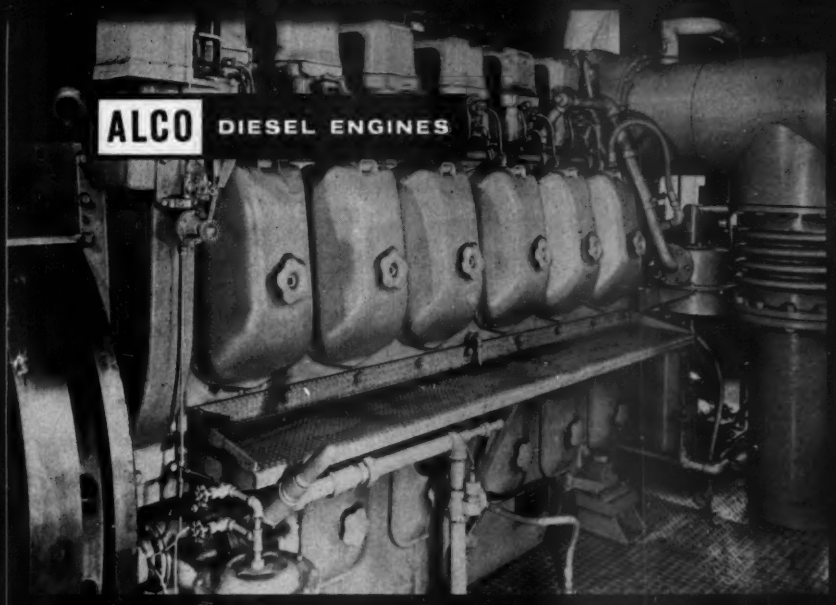

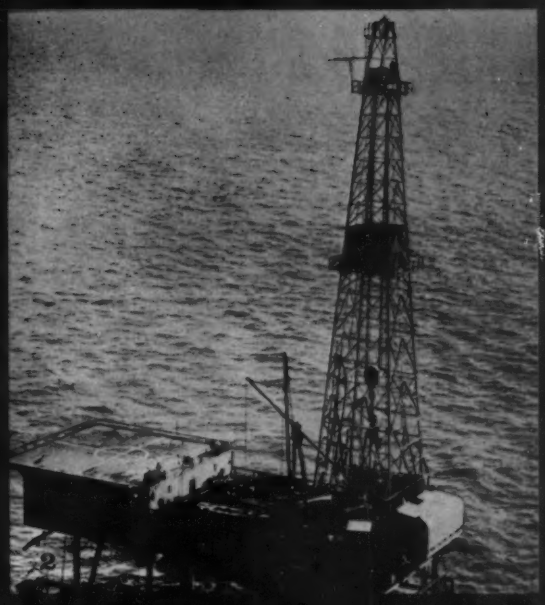

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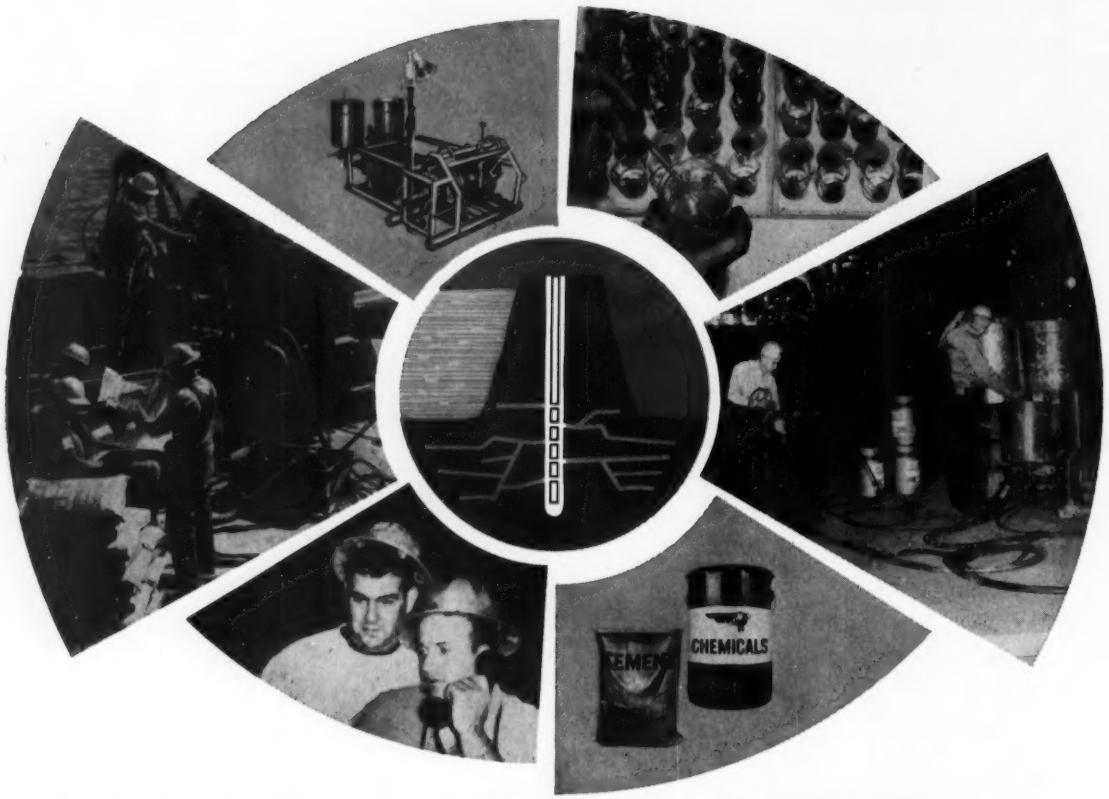

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How *Imaginative Engineering* Put Taming Chicago's

John Dolio (right) in front of Powers Graph-O-Matic Control Panel with E. S. Anderson, engineer for the Illinois Psychiatric Institute.

The unusual temperature requirements specified for the new Illinois Psychiatric Institute presented an extraordinary challenge for John Dolio & Associates. This Chicago engineering firm was asked to provide an absolutely uniform temperature throughout the 11-story, T-shaped building. Because temperature variations cause extreme discomfort —even pain—to mental patients, the system had to be accurate, foolproof and automatic. Because Chicago temperatures rise or fall to extremes within hours—sometimes minutes —the system had to be capable of sensing the changing weather picture outside and automatically and simultaneously reacting inside.

The resulting design provides all the answers . . . in a Powers pneumatic control system that operates automatically 24 hours a day—every day—at a bare minimum of cost; a system that compensates instantly for sudden outdoor temperature changes; a system that can be checked and controlled by one man.

The result is a functional system of control where practical engineering principles were combined by the Dolio firm with a strong helping of ingenuity in order to whip some of the more unusual problems. For example, since chilled water was to circulate through ceiling heating-cooling panels, a safeguard against condensation was necessary. The engineers solved this problem with a series of dew point controls at various locations in the ceilings. Thus, "controls on a control" prevent water temperature from falling to the point at which condensation could occur.

Phil Derrig, Chief Mechanical Engineer of the Dolio firm, inspects one of the dew point controls specially designed to prevent condensation of cold water in the ceiling heating-cooling panels.

Powers Temperature Control To Work Weather At Illinois Psychiatric Institute

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JOB DETAILS

The system encompasses 12 temperature zones, each designed to operate independently in relation to individual zone exposure problems. Ten zones utilize ceiling heating and cooling panels at which hot and chilled water circulate from zone exchangers. Three-way control valves for the water are modulated by pneumatic thermostats in various rooms. Two zones — auditorium and stairwell — have only heat exchangers (the auditorium is supplied with individual conditioned air).

Master outdoor controls sense the changes in temperature outdoors and instantly reset submaster pneumatic thermostats at the zone exchangers. These indoor-outdoor controls are engineered for foolproof maintenance of uniform zone temperatures.

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Temperature controls are inaccessible to patients. All controls in the corridors are wall-mounted and cabinet-enclosed; temperature sensors are mounted in ceiling exhaust ducts.

Easy servicing and low maintenance are two big reasons why a pneumatic system of control was specified by this engineering firm. Efficiency at low cost is characteristic of this type of control — as it is with the Powers pneumatic system installed here.

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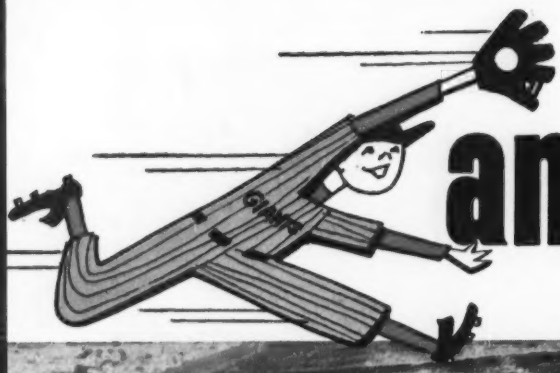

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Hueston M. Smith

– Starts on front cover

In 1930, he was graduated from the public high school of a small town 90 miles north of St. Louis, where his family had moved when he was five. There was some thought of his going to college. However, conditions did not permit. Instead he went to work. It was four years before he had saved enough to enroll in the University of Missouri, School of Mines and Metallurgy, at Rolla. Once his fees were paid, there was little left over.

Food and lodging were obviously the prime necessities, and they must have dominated Smith's thoughts, for he was soon in the business. The landlady running the rooming house in which he lived was leaving town. He filled the void by participating in the organization of a seven-member Engineers' Club through which a satisfactory if scarcely groaning board at $9 a month was provided. Business prospered, and the next year the club had 50-member boarders at $12 a month. Success bred success. During his senior year the club was expanded, taking over a building just off campus, and its membership grew to 75. That Engineers' Club is still going strong, currently operating as one of the three independent engineering clubs on the campus at Rolla.

Military Career

Hueston Smith got his degree in electrical engineering in June 1938. He went to work for the Missouri Public Service Commission, and was assigned to a department engaged in the evaluation and appraisal of public utilities. His group made studies of the Southwestern Bell Telephone Company and the St. Joseph Cities Service Gas Company, but he had been at this for only two years when, in the summer of 1940, he was called into the Army. His ROTC activity at Rolla had left him a reserve officer – a second lieutenant, Corps of Engineers.

The next 18 months saw him first at Fort Ord, in California, for basic training, and then at Camps Shelby, Polk, and Claiburn – assigned to various engineering projects including the design and construction of a 51-mile railroad. Then, just a month after Pearl Harbor, he found himself (now a first lieutenant) leaving N. Y., headed for Australia.

Smith's Army career was far from the usual. He lived in a tent for six years. As operations officer of an Engineers Regiment, he directed the building of air field facilities using initially 1250 men, two teams of horses, and a supply of wooden beer cases as wheelbarrows. Finally, better equipment came, but even then the roller for this first field was an ancient wood-fired steam engine that had managed to survive an initial firing with a dry boiler.

While assigned to this Engineer Regiment, Smith participated in the design and construction of air field facilities, roads, water supply systems, and hospitals for the 350,000 persons (including Army nurse Helen Mercedes, who is now Mrs. Hueston Smith) who were stationed at Port Moresby and Finchaffen, New Guinea. During this period his Regiment received a Presidential Unit Citation for its work. Then, as a lieutenant colonel, Smith took over an ineffective engineer aviation battalion with its morale at about the level of an aroused South African mob. Smith got this battalion into such shape that it became part of the invading force at Leyte, P. I. Later, he commanded an engineer construction battalion in the Manila area so successfully that he received a Bronze Star Medal. His final assignment was as regimental commander of another organization that needed rehabilitating. He left active Army service a full colonel.

Four years of college taught Smith not only some basic engineering but also something about a business operation. Six years of the war provided engineering experience and particularly furnished him a knowledge of men and how to direct them. Today, Hueston Smith is a man molded, but not warped, by his background. He is an engineer; he is a businessman; beyond all else, he is a manager of men.

Professional Background

When he returned to St. Louis in May 1946, he decided that he needed some background in law. He promptly entered Washington University and studied for three semesters. Then, in 1947, he left law school and got a job with the Union Electric Company as an industrial engineer. As he puts it, it was his job to sell power by assisting the customer to fit together men, materials, machinery, and money, to produce a product. Whenever this was done, power sales naturally resulted.

Smith stayed with Union Electric until 1950 and then went with the Fruin-Colnon Company, a construction firm, where he assisted in the organization of an engineering department. Then, he and several engineers left this firm in May 1954 and organized their own firm of consulting engineers, Smith-Hanlon-Zurheide-Levy, Inc. Now, six years later, the firm is an eminently successful St. Louis operation, employing something over 50 people. The firm engages in industrial, civil, structural, mechanical, electrical, and management engineering work. Again, Smith, as president of the firm, is not only an engineer, but is managing men.

Rounding out his personal portrait, Smith is registered in Missouri, Arkansas, Kansas, and Texas. He is a member of the Society of American Military Engineers, the Missouri Society of Professional

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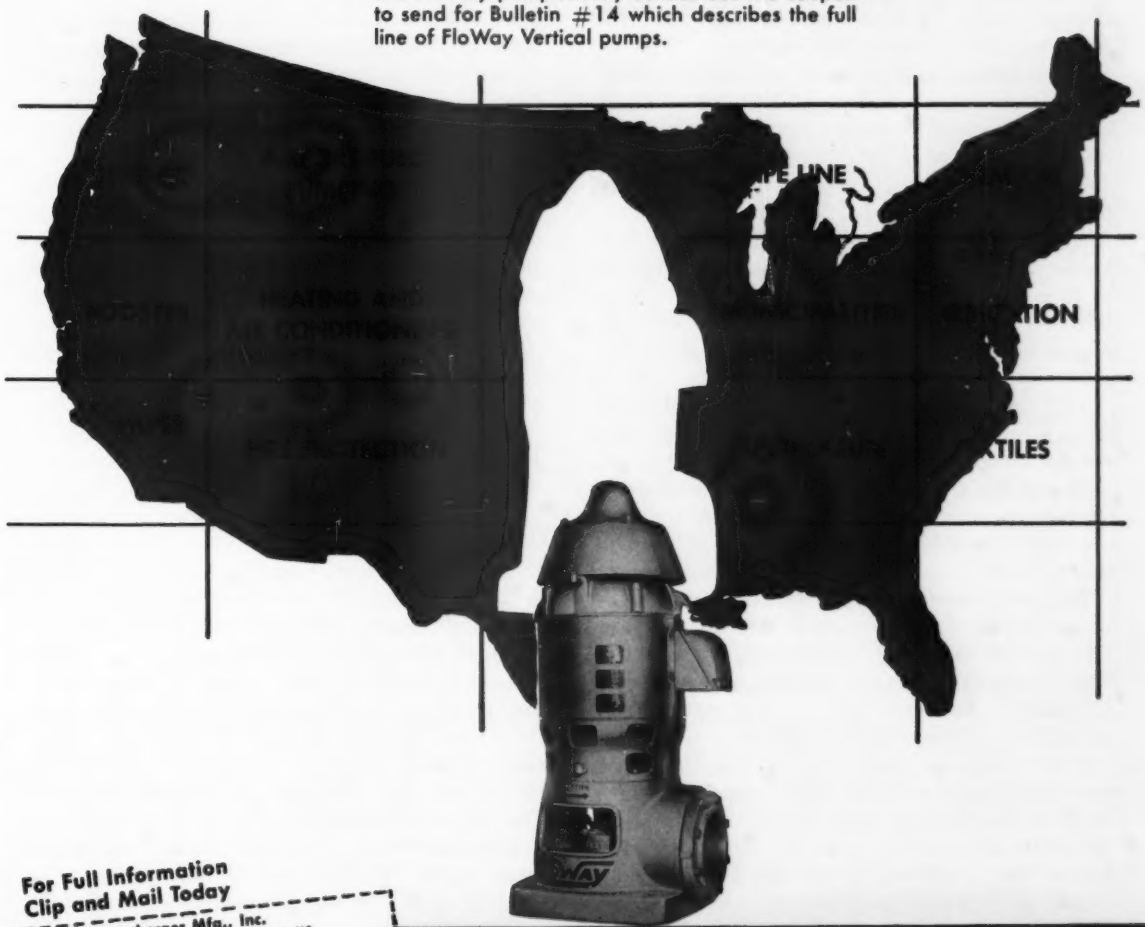

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Engineers, the American Institute of Industrial Engineers, and the Reserve Officers' Association. He is also extremely active in the Missouri Association of Consulting Engineers and is a past president. He is a professional member of the Eta Kappa Nu Association, a national honor society.

Plans for CEC

It is, however, as the newly elected president of Consulting Engineers Council that Smith is currently prominent, and it is his opinions and plans as president of this great national organization that can influence the professional affairs and well being of every other consulting engineer.

What does Smith plan to do with CEC? What changes can we look for? In what directions will his energies, as president, be aimed?

In predicting Smith's term of office and its orientation, it must be kept in mind that over the past four years most of his interests have involved membership activities. He has been engaged in other Council work, in fact, served as secretary for one term, but membership has been his real interest. The Council has had a phenomenal growth in a short time, and all the credit for this must be given to two men – Tom Roche, of Minnesota, who initiated the membership drive prior to the formation of the council, and Hueston Smith, who has directed the program since 1956.

The Council got its start in the fall of 1955, when representatives of 10 state and regional associations of engineers met in Smith's home town, St. Louis, to study the advantages of affiliation. At this year's May meeting, in Oregon, the 31st association joined the Council. This is an obvious tribute to the membership work of Hueston Smith.

He is not yet satisfied. He sees areas in the country where there are associations now in existence but not affiliated with the Council – Tennessee, South Carolina, Wyoming, Arizona, and Arkansas, for example. And there are yet other states – Virginia, West Virginia, North Carolina, and Alabama – where there are currently no associations of consulting engineers. While Smith does not intend to make membership a presidential function, he does intend to watch over it. He hopes to see his term as one of continued growth. He not only wants to get the independent associations into the Council, he wants to encourage the establishment of associations where now there are none.

There is another type of membership work that Smith wants continued. The associations currently affiliated with the Council are still weak in some ways. In a few states, such as Texas, the association started out as basically local (around Dallas) rather than state-wide. This has just been changed in Texas and should be accomplished in the other states where comparable conditions exist. There are other associations that are restrictive in their membership, limiting themselves to consulting engineers in interprofessional practice. That is not as it should be, Smith feels. He also thinks that in several instances there is less need for both state and city associations (i.e., Chicago and Illinois) in the same area than heretofore experienced. On that account, a merger should occur in the foreseeable future.

While Smith would encourage changes that would make affiliated associations fully representative of all types of consulting engineers in an area, he does not want to bring about these changes by executive fiat. Instead, he feels that all the associations will gradually adopt the ways of the most worthy. He thinks that you have to get them into church before you can convert them. He says, "Take them in and show them how they should be organized, and then they will be in a position to straighten out their problems locally."

History has been on his side. The 10 charter associations were about as different as any 10 associations could be in their rules, their regulations, and even in some of their aims. Today, while they still have differences, they are so much alike that no one doubts the propriety of their affiliation.

Individual Memberships

The most radical change in membership in the Council took place at the recent May meeting at which Smith took office. The number of members suddenly changed from 31 to 1500. Under the new bylaws adopted at this meeting, each member of each affiliated association became a member of Consulting Engineers Council. Now, each person or firm representative can consider himself or his firm a full member. Not only does this bring consulting engineers as professional persons – and their firms as professional firms – closer to the Council, but it has some side benefits. The Council, with 1500 members, will become an Associate rather than an Affiliate member of Engineers Joint Council and will get a participating vote in that body. This will mean that CEC will have a strong voice in inter-association affairs and can take its proper place on the EJC-AIA Joint Committee.

Smith strongly favors full cooperation with other organizations representing persons with whom consulting engineers must deal. He feels, for example, that the tie with AIA must be drawn tighter, and he favors closer contact with contractors through the Associated General Contractors of America, Inc. and the several subcontractor groups. He wants this also to extend to a strengthening of the already existing joint committee with the Producers' Council. And, as Smith points out, the

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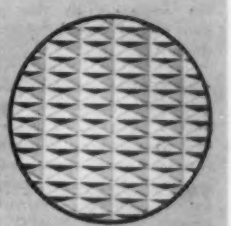

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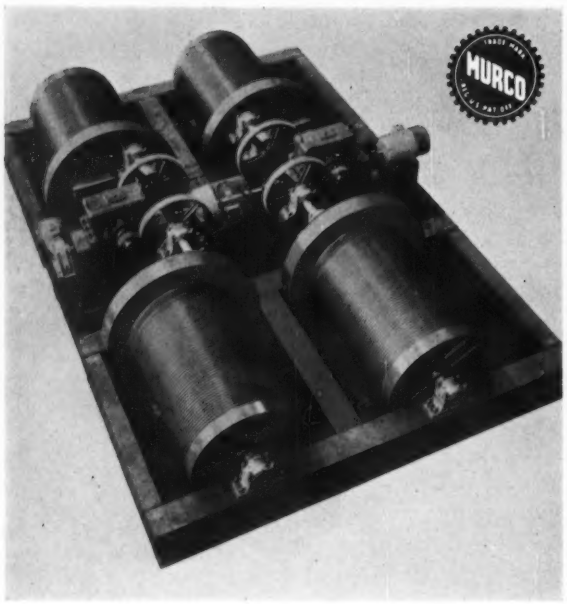

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The engineers on this project are Uhl, Hall & Rich of Boston, Massachusetts.

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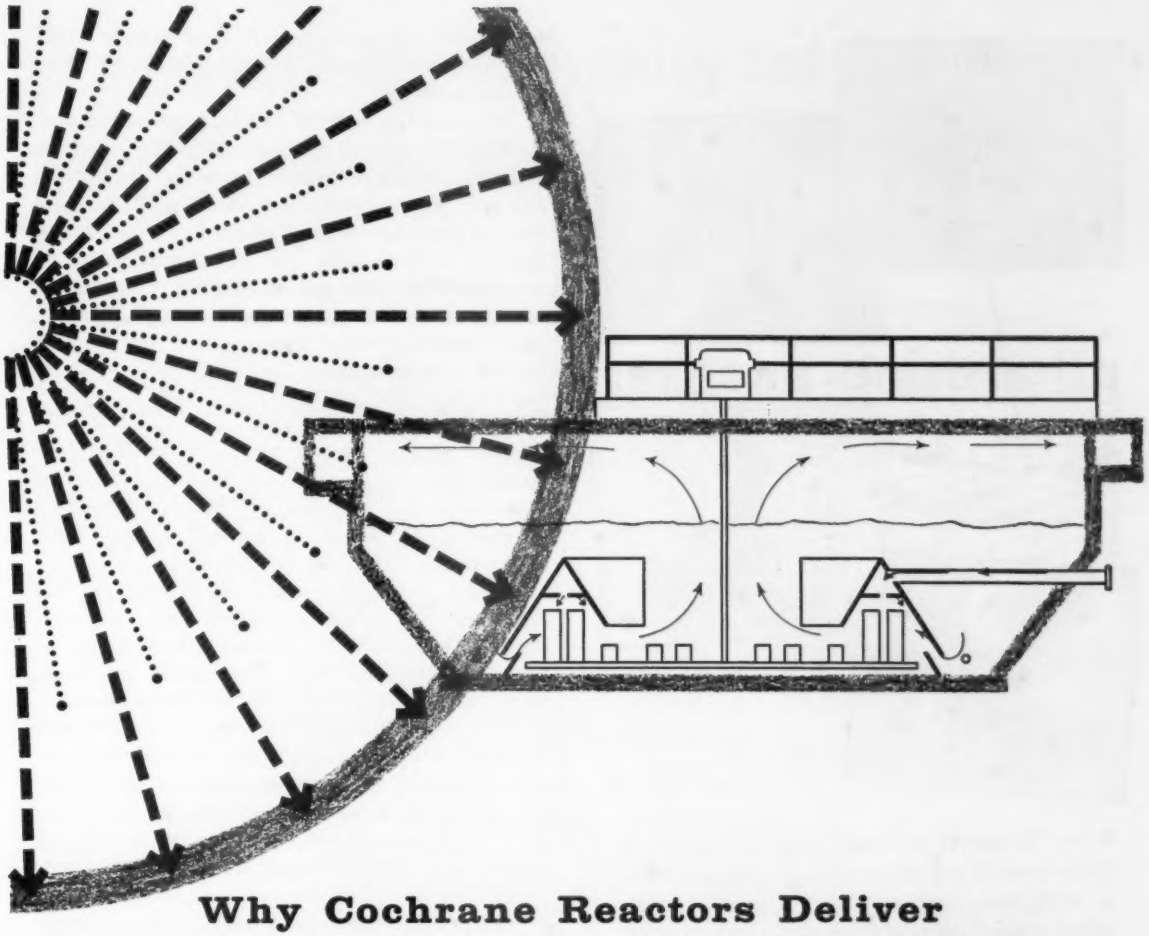
Producers' Council, broad as it is, represents only the manufacturers of certain types of building products – by no means all the products specified by consulting engineers. There is also the Materials Handling Institute, the Asphalt Institute, the American Concrete Institute, and tens of others. The Council cannot establish a joint committee with each of these important organizations, but it can be fully aware of the field in which each functions, and there should be an already established means of contact when the need for contact arises.

Views on FIDIC

Equally important is the means for communication and cooperation within the profession. The Council is a member of the *Federation Internationale des Ingenieurs-Conseils* (FIDIC), and is already a part of the international picture. Smith is in favor of active participation in FIDIC affairs, and it is his intention to aid in every possible way in making FIDIC fully aware of its potential as the international body representing engineers in private practice. He feels that FIDIC is just reaching a point at which its influence can be felt.

"It must be active, it must be genuinely international, and it must be firm in its principles. We want to contribute to it, and we want to learn from its other affiliates. In the past FIDIC has always had great dignity, but it has perhaps failed to participate, to act, to lead as forcefully as it might. This is to be expected, for it has been a predominately European international body during times when Europe has not always been too inclined toward internationalism; but for the past 10 years this has been changing and Europe, once the essence of petty nationalism and restraining chauvinism, is now the world leader in economic and political union between states. This gives FIDIC a new chance. Surely there is much FIDIC can do to make certain that the private practice of engineering within the Common Market, perhaps even in the Outer Seven, can be set up on a fair and professional basis. This means that certainly Italy and presumably Luxemburg must be brought into FIDIC. And it would do no harm to have a look at the possibilities of bringing in those two outermost members of the Outer Seven, Portugal and Austria.

"Perhaps I am again showing my overriding interest in membership, but I merely point out that FIDIC has by no means finished its membership drive in adding the United States, Canada, South Africa, and Australia. The new political and economic groups of Europe demand some attention from FIDIC, for these new trade areas are going to mean new patterns of practice for all consultants. As the principal international body, FIDIC has



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frightening responsibilities. It must assume them. We, here in the United States, are willing to help wherever we can.

"While on the topic of international cooperation, it should be pointed out that while CEC and the Canadian Association are both members of FIDIC, our close geographical and economic position means that we need even more. I would like to see a joint meeting with Canada arranged sometime during my term. If it is impossible to get a joint meeting of our board, perhaps we could arrange a special, joint executive committee meeting in Toronto, Montreal, Buffalo, or Boston."

Public Relations

Another area of interest for Smith is public relations. He wants to see an intelligent program undertaken that will properly put the consulting engineer before the public, particularly those parts of the public that are potential clients.

"I think some progress has been made in this direction, but it is not an easy job. Fundamentally, these are local, or rather a series of local problems. Nationally, we can provide guidance and communication, but each local association must conduct its own program. Public relations is not a matter of buying big advertising space or of getting one or two articles in national magazines. Those big splashes are fine, but they are expensive and their effect is not so long lasting as it might be. If local people deal with local people, we get what we want. I would like to see every association set up its own public relations program. This is not simply a matter of newspaper or radio coverage of Engineers' Week. Instead, it amounts to a multitude of little activities, mostly personal, that soon makes the local government officials, the manufacturers, and the other professional persons conscious of consulting engineers and their associations. There are right and wrong ways of going about this, and the national organization can do its best work in guiding the local groups.

"CEC can do excellent work on the national level in Washington. I want to see our office there. I want to see our Washington activities carried out under good men who are part of a permanent staff. All this will come, and I am going to accelerate it every way I can during my administration. We have done some good work. It should be continued. We now have many good friends in Washington. We want to keep them, and we want to extend our acquaintance.

"I think we are doing a good job with our special program designed to promote the use of consulting engineers on government engineering projects. Our objective here is not confined to the Interstate Highway Program by any means. What we are

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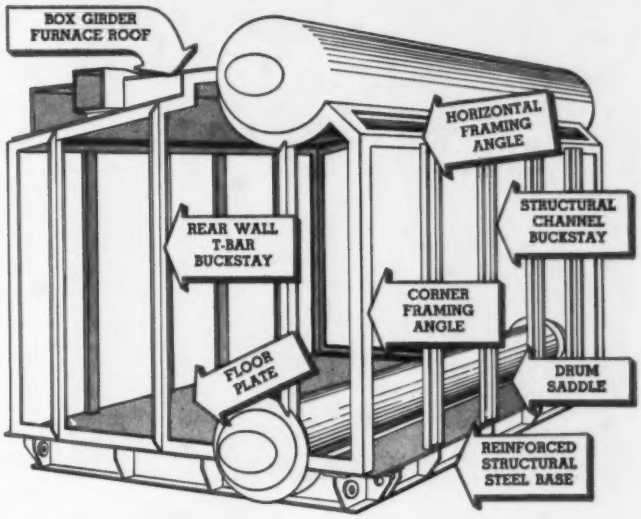
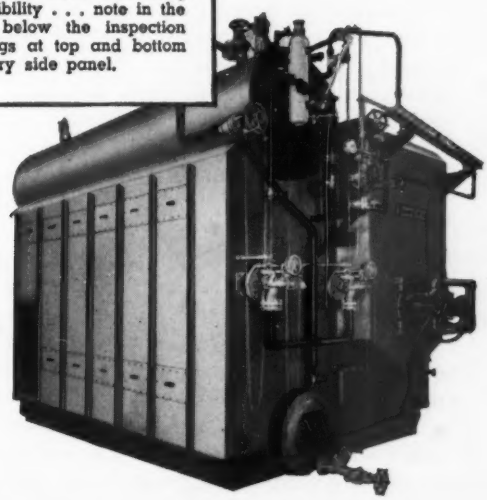


All this without sacrificing accessibility . . . note in the photo below the inspection openings at top and bottom of every side panel.



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really after is 'Private Practice on Public Works.' Our program is nothing more than the promotion of private enterprise within this relatively small area of engineering. We do not hope to guide the whole economy alone, but if we work effectively for private enterprise in engineering, we will be more than holding up our end. And we are not satisfied to simply stem the tide of government in competitive business, we want to reverse it.

"We propose to cooperate with every other organization that chooses to participate in this program with us. We want all the help we can get, and we are in favor of joint efforts. It should be possible for all interested organizations to combine forces on this matter without any material duplication of effort. We are in favor of having engineers in private practice do the maximum amount of engineering for the government consistent with the most economical cost to the taxpayer. We are convinced that consulting engineers can do and have done economical engineering work on government projects. In order to evaluate comparative costs of government engineering vs. private engineering, it will be necessary for government agencies to establish a suitable accounting system which will reflect true engineering costs. We believe that government engineering departments should be maintained with a staff adequate for the normal work load. This would include basic planning, approving, and supervising programs designed by consultants and built by independent contractors.

"Any organization that wants to join with us on this, we welcome to the ranks of those who believe that government should serve the purpose for which it originally was intended. Our country was built on the private enterprise system. If we are to remain strong and continue to grow, private enterprise must maintain its strength. Therefore, engineers in private practice should support the joint efforts of those who favor this program. CEC is standing solidly in the interests of private practice."

Ambitious Program

These are just a few of the plans Smith has for his term. There are other matters of importance. Smith hopes to handle them.

¶ Registration — Consulting engineers are, of legal necessity, more concerned with registration than any other engineers. CEC is and will continue to work with NCSBEE on Model Law revisions.

¶ Telephone Listings — Uniformity across the country is a necessity. The listings should distinguish between engineers in private practice and other registered engineers. This is a business essential.

¶ Legal Guide — Some compilation of basic abstracts of cases involving engineers is needed as a guide. Government groups need to be shown, for

Wanted
Assistant Editor

We need a young man for our editorial staff. He should be in his twenties or early thirties and must have had some experience on the editorial staff of a business or professional magazine.

The position is one involving general editorial work from author contact through writing to final proof reading. Applicants also should have a proven ability to write, rewrite, and report.

Familiarity with the ways of consulting engineers is an advantage, and an engineering degree or a good technical background is desirable.

Location will be the editorial offices in St. Joseph, Michigan, but there will be some travel involved in contacting authors and attending meetings and conventions.

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example, the legal precedent for negotiations for professional services.

¶ Documents – Some good documents have been prepared by CEC, but more are badly needed, and they need to be advertised and distributed. Information is useless until disseminated.

¶ Education – There are excellent groups at work on engineering education – Engineers Council for Professional Development and the American Society for Engineering Education – and CEC does not have any desire to take over their work, but they should be informed of the need for student instruction in courses that might lead toward careers in private practice. A graduate year in private practice problems is not inconceivable for some schools.

¶ Office Practice – There is need for more data on costs, employee relations, office systems and machinery, and client contact procedure. CEC can do much more in this area.

¶ Ethics – There is a constant conflict between business ethics – dollar ethics – professional ethics. This is a complicated subject. We have just begun to deal with it. We hope for some real progress.

¶ Council Organization – We are getting too big to function on a one-association – one-director basis. Thirty-one members and 31 alternates means 62 men, plus the officers, around the directors' table. That is too many for a body that tries to administer as well as formulate policy. We are going to have to go to some sort of regional plan. I do not know what it will be, but generally, we will have to arrange for a more powerful executive committee, a board that simply directs and approves, and then, perhaps a general convention of all members (all 1500) once a year. This comes under the heading of long range plans, but they cannot be put off too long. We are somewhat unwieldy in our structure.

¶ Communication – We have a new problem. It was difficult enough to communicate effectively with the associations as members. Now, there are about 50 times as many to inform. We are going to have to continue to improve the *Newsletter*, and there is going to have to be a direct mail program that lets CEC contact every member with memos, letters, and data whenever there is something he should know. We must tell them what is going on.

"I am convinced that informed groups come to wise decisions. Most mistakes made by associations are made through lack of information – not misinformation. When a man or a clique tries to mislead a group, there is generally counteraction, and the whole matter comes to the attention of the whole membership. That is good. It is when there is no attempt to either lead or mislead that associations get into trouble. Lack of communication is a form of suffocation. I want to be sure that we have an informed membership." ▲▲

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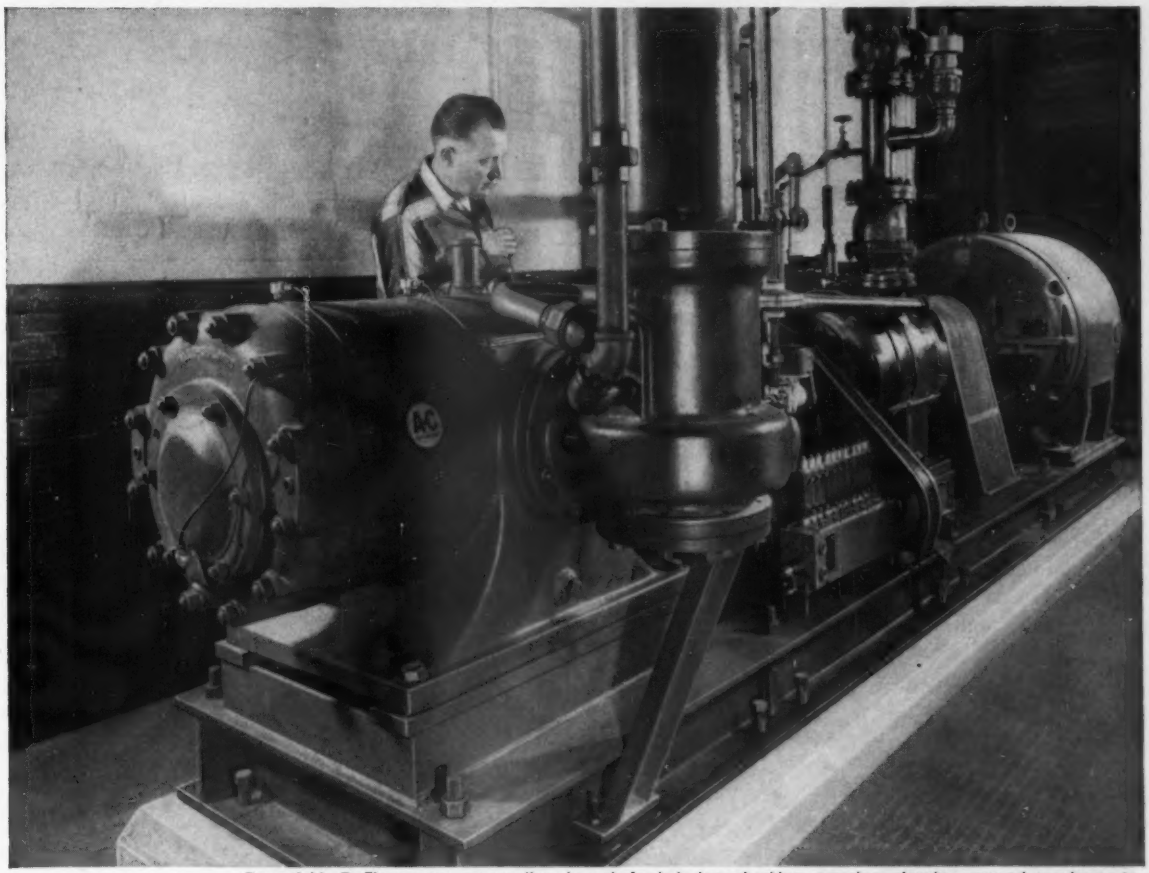

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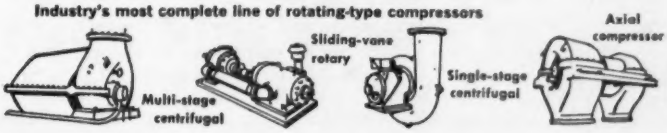

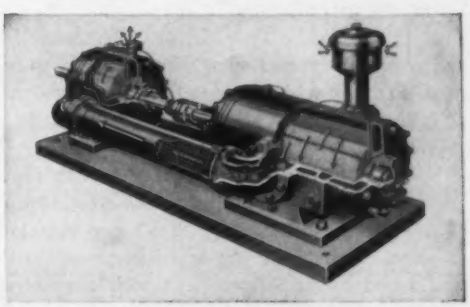

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From the Editor's

Tranquil Tower

Private Enterprise at a Price

Suo sibigladio hunc jugulo

Terence

THE BOARD OF DIRECTION of the American Society of Civil Engineers has pinned a price tag on private enterprise. According to ASCE, private enterprise is the proper economic system for this country only when it is more efficient and cheaper than any other. If the government can do a job better or at a lower price than private enterprise, then the government should do it, say the Civils.

A policy statement of the Society, prepared by the Secretary and adopted by the Board of Direction, on March 7, 1960, concluded, "There is a proper and desirable place for both public engineering bureaus and for engineers in private practice in the performance of engineering functions in governmental agencies. It is only the degree to which either type of service *can most efficiently be employed* that is subject to determination in a specific instance." So it comes down to nothing more fundamental than that which "can most efficiently be employed!" Shades of Mussolini and the trains he put on schedule!

That is not all. We find, in addition, that "The degree to which design and construction functions should be undertaken by government bureaus would properly be determined on the basis of cost . . . Design and construction should generally be performed by the bureau only when it would be clearly less costly than equivalent work by private practitioners."

There can be little doubt concerning the meaning of these statements. What they say in substance is, "To hell with the idea that one economic system is fundamentally and ethically superior to another. What matters is efficiency and price."

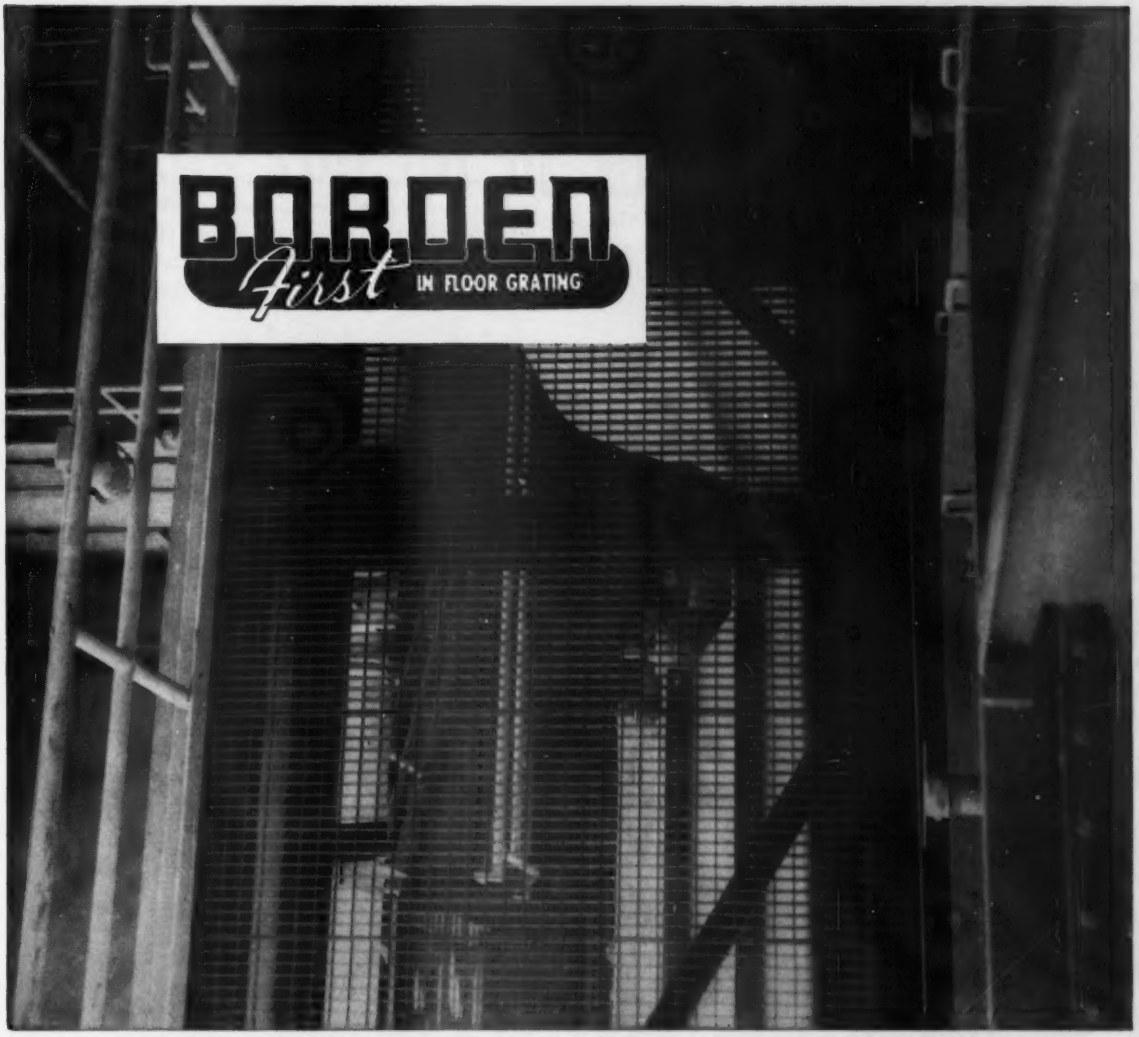
When this policy statement was first published in *Civil Engineering* and in this magazine ("Heard Around Headquarters," May), we refrained from comment because the statement was partially redeemed by an Appendix, which purported to list some advantages to the public in the use of private engineering services by government agencies. In addition to other benefits, this Appendix listed "Affirmation of the principles of free enterprise."

True, one got the feeling that this was mere cant tossed in as an afterthought once efficiency and lower cost had been established as on the side of the consulting engineer, but at least lip service was paid private enterprise.

Then, according to *Civil Engineering*, there rose a great clamor from the "grass roots" (presumably, the grass roots of Boggy Bottom; grass roots watered by the Potomac, nurtured and fertilized by the Pentagon). Responding, the Executive Committee reviewed the entire question on April 22. And what did they do? Did they acknowledge their error in having stated that the choice between private enterprise and government-in-business (call it socialism, fascism, or what you will) involves no more than "which is more efficient; which is cheaper?" Did the American Society of Civil Engineers take this opportunity to reconsider; to reaffirm its belief in private enterprise and put political principle above price comparison?

Not at all! Unbelievable as it sounds, the Executive Committee, in response to the demands of its government employee members, deleted the Appendixes. The statement that the use of consulting engineers on government projects is an "Affirmation of the principles of free enterprise, which are implicit in the concepts of sound economy under a democratic form of government," has been stricken from the record. ASCE is no longer hobbled by any allegience to the free enterprise system.

How could ASCE have done this? The only answer seems to lie in a sentence to be found in the second paragraph of the original statement. "The Society's 44,000 members include more than 13,000 professional engineers in the service of all levels of government, and at least 9500 engineers engaged as principals or employees in the private



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practice of engineering." The consulting engineers are outnumbered.

Explaining this unprincipled action, the Executive Committee has the effrontery, after deleting the Appendixes and after equating the public interest to "efficiency," to say that "the public interest is paramount in any decision between public and private engineering service." And to what Star Chamber are consultants condemned for judgment? The Executive Committee's answer is that "Competent administrators of public engineering bureaus, equipped with complete and accurate cost data, can make these decisions." Here is true justice; the consulting engineer is dragged before a jury of his competitors.

The Federal government itself does not take so antipodean a position toward private practice. Bulletin 60-2 of the Bureau of the Budget includes this statement: "It is the general policy of the administration that the Federal government will not start or carry on any commercial-industrial activity to provide service or product for its own use if such product or service can be procured from private enterprise through ordinary . . . channels."

Clearly, there is no difficulty in securing the services of engineers in private practice through ordinary channels. This government publication goes on to state that where price is involved, the continuation of government operations on the grounds that procurement through commercial sources would involve higher cost may be justified only if the difference is found to be "substantially and disproportionately large." That is a reasonable statement and makes sense. The ASCE statement, placed alongside it, does not.

And there is not only this matter of political principles and support of our economic system, the ASCE policy statement involves also a serious infraction of the Society's own Code of Ethics.

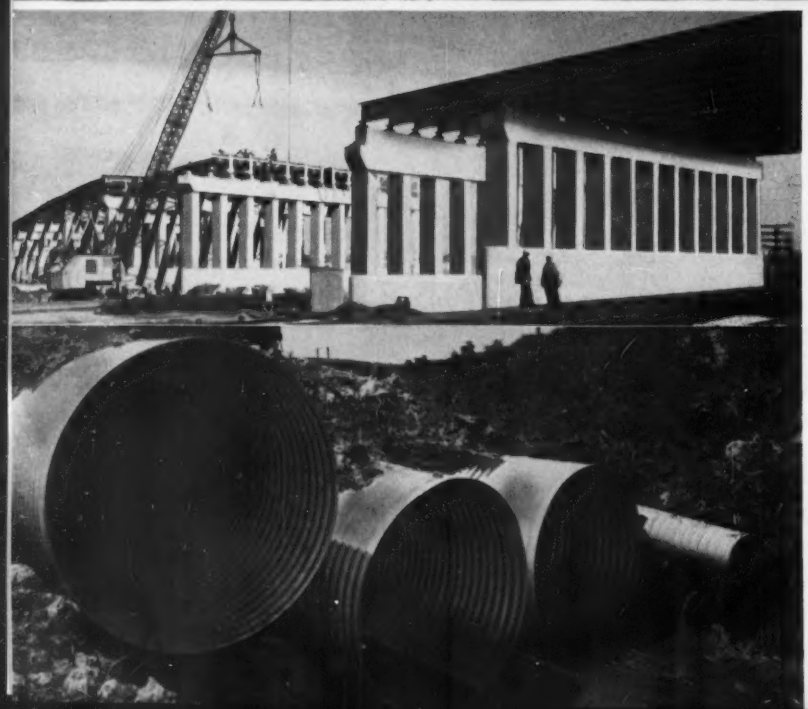
The position is one of expediency. It neglects principle and leaves the outcome to economics. *Whosoever shall enter the lowest bid shall get the job.* No consideration is given to quality of work or professional dignity. Is not this an approval of the concept of negotiation for professional services on a price basis? Is not this contrary to the Code of Ethics, which states that it is unprofessional and inconsistent with honorable and dignified bearing for any member to involve himself in negotiations in which price is the prime consideration? In this affair the Executive Committee of ASCE is making price the justifiable basis for the selection of an engineer — and on a grand scale involving all government projects. The ASCE Committee on Professional Conduct has a case against its own Executive Committee. ▲▲

Interstate road construction on the go in Illinois

Interchange of U.S. Route 41 and Touhy Avenue in Lincolnwood, Cook County

Additional story and pictures on following pages ▶

Illinois builds 1,608 miles of



Left and above: Here are two of 2257 new bridges being built in Illinois. New bridges often carry traffic *over* previous bottlenecks, make for safer driving conditions, cut traveling time. In some cases creek or river beds are being altered so bridges can be placed in better locations. Many new bridges speed up traffic flow, are replacing old, narrow and unsafe structures. In most cases, USS Structural Steel offers the fastest most reliable and economical method of construction.

Culverts made from USS Galvanized Culvert Sheets are ideal for highway drainage. They completely absorb forces of impact and vibration, so they are excellent for use in high-traffic areas. Strict quality control through every step of production assures long life and dependable performance. Culverts shown here are on Interstate Route 74 in east-central Illinois.

Interstate roads

Products of U. S. Steel help keep Illinois roads on the go

Across the rolling prairies of Illinois a wide spiderweb of new highway construction is growing day by day. According to the Interstate Cost Study prepared by the Division of Highways of the State of Illinois in 1957, the estimated cost of 1,608 miles of new interstate roads and approximately 2,260 bridges in Federal and State funds would be $2,265,573,000. Already, 234 miles of road and 404 bridges have been completed, and under construction today are 140 more miles of road. This new highway network is part of the greatest building project of all time—the nationwide Interstate Highway System. It will relieve congestion and improve the safety record of roads in this rich agricultural-industrial state.

U.S. Steel provides much of the material for the Illinois road-building program. Cement, slag, reinforcing bars and welded wire fabric go into the highways and high-strength and constructional alloy steels, sheet piling, tubular piles go into bridges; drainage products made of USS corrugated galvanized culvert sheets or concrete carry away excess water. Wire rope, cable, tubing and special steels go into the construction equipment that moves the mountains of earth and lays the right of way. For safety, USS furnishes fence, beam and cable guard rail, steel for signs.

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Illinois Interstate Highway network. Solid green lines indicate completed mileage or mileage under construction. Green dots are planned mileage or existing Illinois highways that will later go into the Interstate Program.

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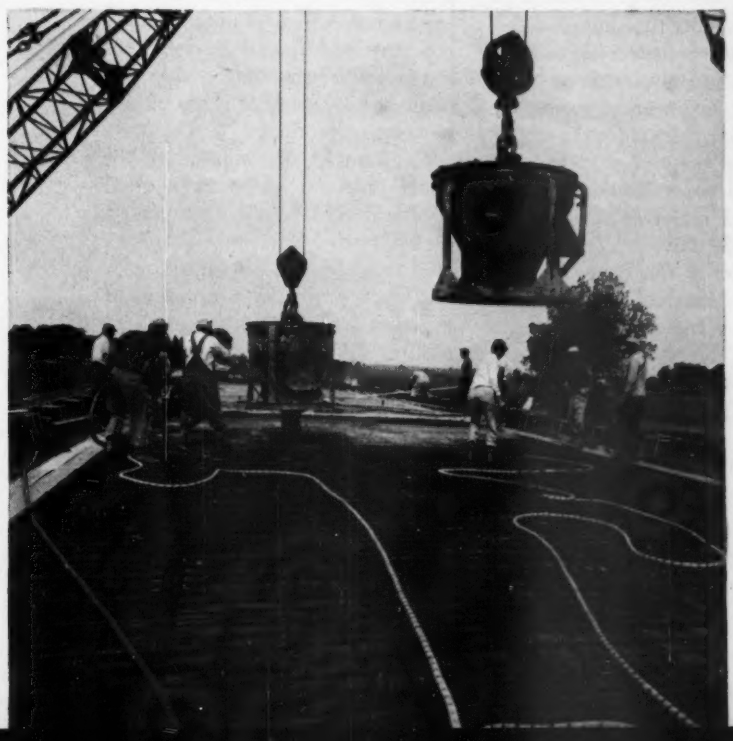
The highway market is served by the following divisions of United States Steel: American Bridge Division, Pittsburgh, Pa.; American Steel & Wire Division and Cyclone Fence Dept., Cleveland, Ohio; Columbia-Geneva Steel Division, San Francisco, Calif.; Consolidated Western Steel Division, Los Angeles, Calif.; National Tube Division, Pittsburgh, Pa.; Tennessee Coal & Iron Division, Fairfield, Ala.; Universal Atlas Cement Division, New York; United States Steel Supply Division, Steel Service Centers, Chicago, Illinois.



These men direct the Illinois highway building program (left to right):

William G. Stratton, Governor of Illinois.

Edwin A. Rosenstone, Director of Illinois Department of Public Works and Buildings.

Ralph R. Bartelsmeyer, Illinois Chief Highway Engineer & Immediate Past-President of the American Association of State Highway Officials.

Workmen pour concrete for bridge surface on Interstate Route 55. U.S. Steel supplies DI-LOK reinforcing bars for concrete construction as well as Steel Sheet Piling, USS Steel H-Piles, and Structural Carbon, Alloy and High-Strength Steels for the bridge itself.

Write for the **free** *54-page booklet, "Keep Our Roads on the Go." You'll find all the United States Steel products and services that will help you cut costs and speed operations in highway construction. United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.*

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Write for new Bulletin 40

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Readers' Comment

Most Admixtures Are Good . . .

Congratulations on your fine article "Admixtures . . . Fifth Ingredient For Concrete," which appears in your April issue. I have frequently stated, at technical meetings and to clients, that concrete without air entrainment, without water reducing admixture, and without pozzolans (the three ingredients I have called the "antibiotics" of concrete), should be found in the museum showcase only. Although there are occasional exceptions to such a generalization, it is true for most concrete. Just as the modern doctor would not consider practicing medicine without taking advantage of antibiotics, so the modern engineer should not use concrete without these ingredients that improve the concrete and enhance its properties. Unfortunately, such acceptance by the engineering profession has not taken place, in spite of the considerable mass of data to support such a generalization.

Perhaps a major reason for the lack of such universal acceptance by engineers of the value of such additions to concrete is the aura of secretiveness and mystery that admixture producers have surrounded their products with. This makes the professional engineer dependent on the producers' salesmen, each of whom extols his own product and the special features of it, in lieu of making available to the engineer factual scientific information with which he can decide for himself what to use for which application. That is why I feel that your statement " . . . that admixtures were moving from the patent medicine shelf to the prescription drug department" is somewhat premature.

Actually, even though there are some minor differences between the admixtures produced by the well known companies, the job variables, and other materials in the mix are so much larger, that for practical purposes, one can get the properties he desires with nearly any of the products, by a proper adjustment and combination of ingredients. It is simply a matter of experience, which is unfortunately not very widespread as yet. This is of course true of the development and adjustment stage of any new set of products.

I agree with Mr. White that "or equal" has no place in a good specification. I would, however, go a step further and state that in a civil engineering specification a trade name should not appear if the specification is to be used for bidding. When one buys without bidding, one has the right to buy any article he chooses, and which he thinks will serve his purpose. But when an article is to be obtained by bidding, the presump-

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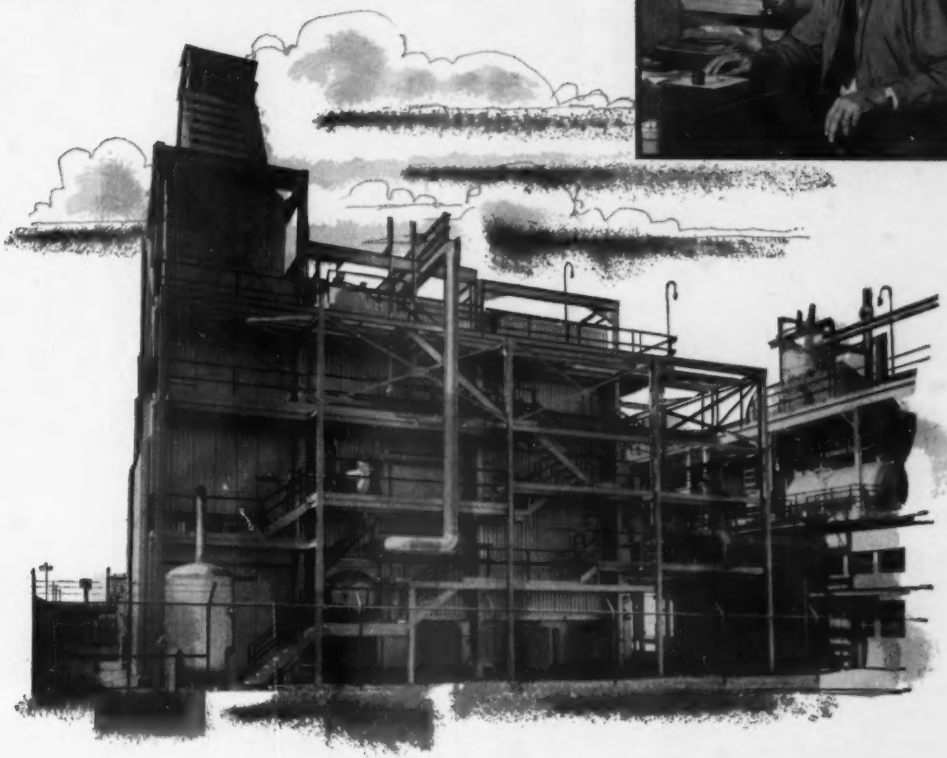
Calvin W. Beard, Superintendent of the Electric Utilities of Bryan, Texas, Municipal System: "As in every other power plant, our steam generator must give completely dependable performance day in and day out".



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174

WICKES BOILER CO., SAGINAW 16, MICHIGAN, DIVISION OF THE WICKES CORPORATION

tion is, of course, that everyone is to be given an equal chance, as long as he can meet the specification requirements. It seems to me that the product mentioned by trade name in a specification certainly gets an advantage over other products that might serve the purpose. The suggestion given by Mr. White that the bidder can offer a "substitute" does not materially change the "or equal" clause except in the wording, as the final effect is that the substitute supplier has to prove that his product is the equal of the product named in the specification. Thus he is placed under a handicap before he starts, and certainly the equal opportunity basis of competitive bidding is thereby defeated.

For use on the Illinois Toll Highway, I developed a specification for water reducing retarder types of admixtures, without the use of any trade name. It served the purpose adequately, even though I would change it in parts for today's market, as we have learned a lot more on the subject in the intervening five years.

At any rate, whatever the problems, I am satisfied that admixtures are here to stay, and will be used more and more widely in the future.

Edward A. Abdun-Nur
Consulting Engineer
Denver, Colorado

One Is Best!

I am personally acquainted with Mr. Abdun-Nur and I have a high regard for his knowledge of concrete. I am in complete agreement with his statement that "the product mentioned by trade name in a specification gets an advantage over other products that might serve the purpose." This is my stand. I claim to have a fair knowledge of materials of construction, with particular reference to water reducing-set retarding types of concrete admixtures, and I have a firm conviction of the one representative proprietary material of that type which I consider best suited for my purposes and have no hesitation whatever in specifying that material by trade name, with every expectation that that material will be used on the job. I am not known for a weak-kneed approach to this or any other situation. I am completely out of step, for instance, with the code number identification method used by ACI for reporting tests of proprietary materials; everybody knows, or can readily find out, what they are attempting to disguise and safeguard.

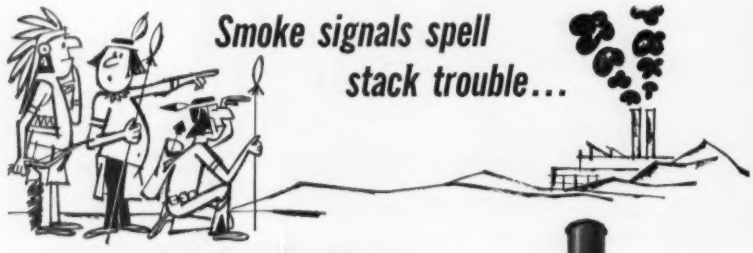
I disagree with Mr. Abdun-Nur's position that the "or equal" clause is not laid to rest by the method advocated by me, as well as by many prominent architects and engineers, when a trade name is used in the specifications, accompanied by provisions for the bidder to name substitute materials supported by test and other data and by a statement of price differential. The burden of proof rests with the bidder and should not be imposed on the engineer after the award of contract.

John J. White
Parsons, Brinckerhoff, Quade & Douglas
New York, New York

Contemplative Flavor

I have long been a devoted reader of CONSULTING ENGINEER, by way of the UCLA Engineering Library. I have found particular enjoyment in the scholarly articles about the engineers of antiquity. Yours is one of the few American journals (to my knowledge) in which technical material of a somewhat more contemplative flavor may on occasion be found. My copies, when I have read them, will be given a permanent home with a budget-constrained engineering librarian of my acquaintance.

L. R. Chase
Editor
Foreign Projects Newsletter
Van Nuys, California



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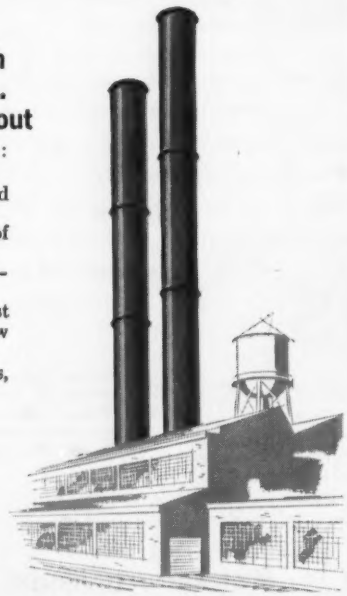

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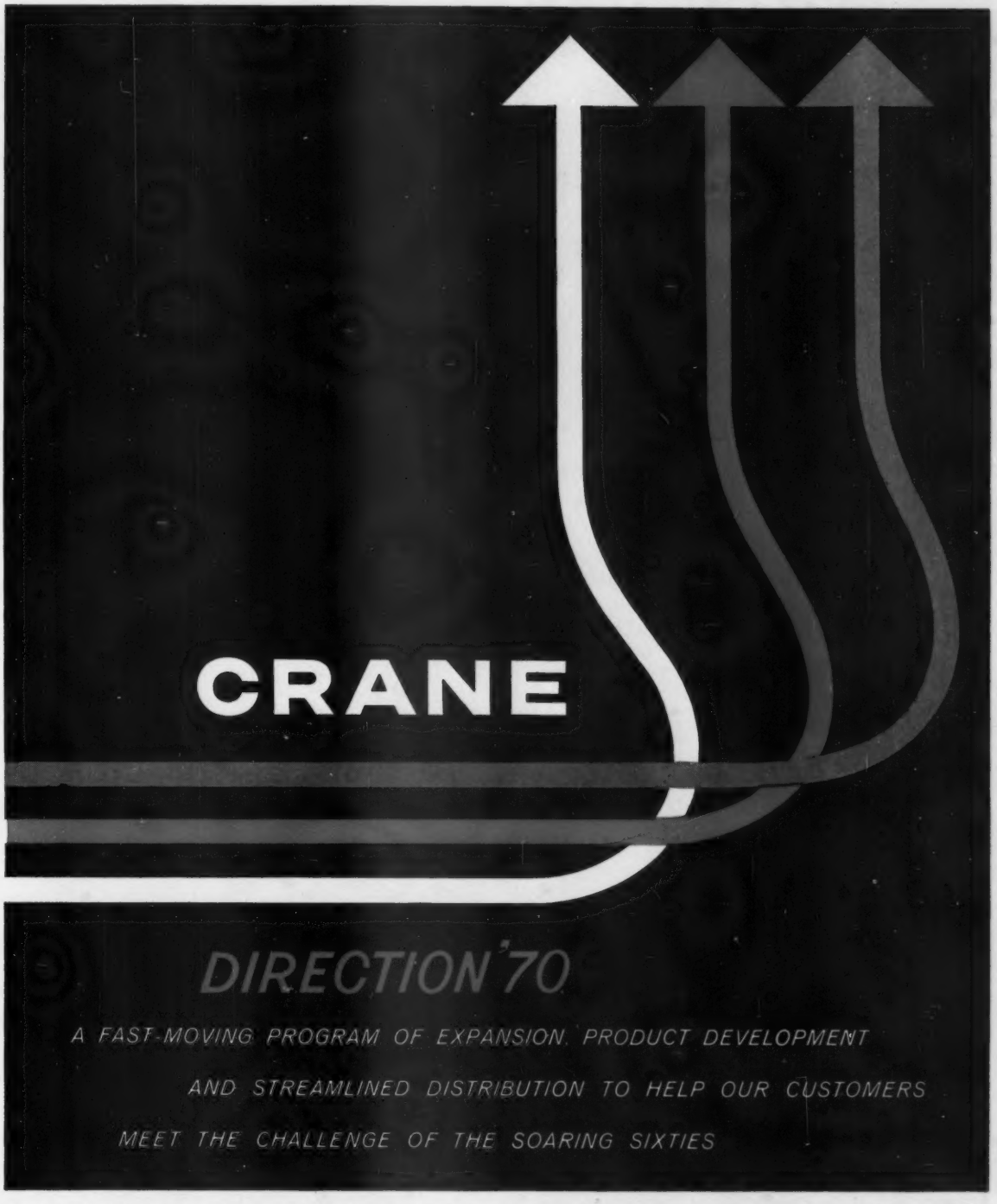
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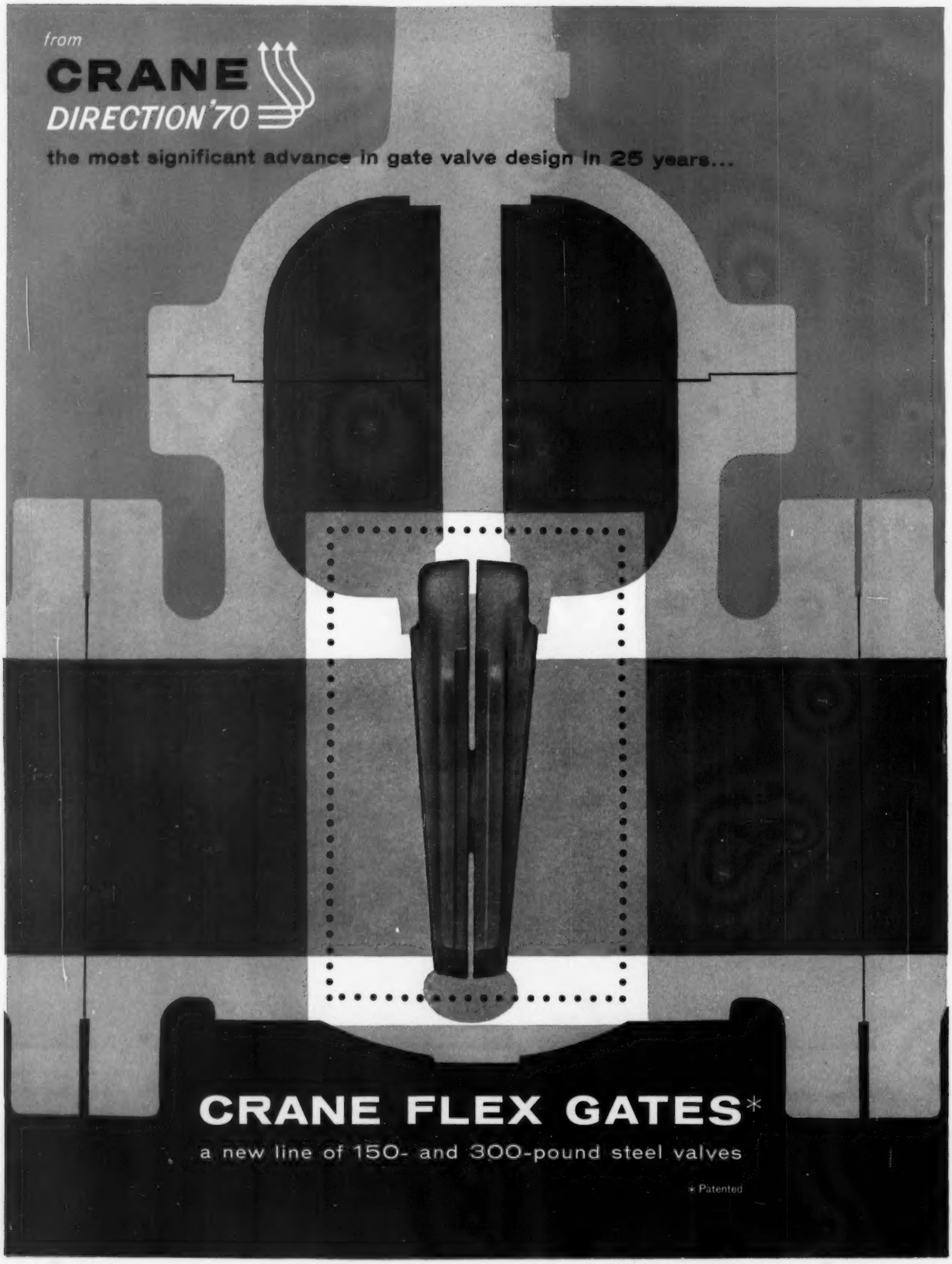
DIRECTION '70
A FAST-MOVING PROGRAM OF EXPANSION, PRODUCT DEVELOPMENT
AND STREAMLINED DISTRIBUTION TO HELP OUR CUSTOMERS
MEET THE CHALLENGE OF THE SOARING SIXTIES

The Soaring Sixties have begun. This is the decade to be marked by accelerated industrial growth. By 1970, predictions are that . . .

- machinery production will double
- petroleum production will increase 4% to 5% each year
- chemicals are to double their present output at the current compound growth rate
- food processing will rise nearly 40%, paper and allied industries will expand about 60%

Total industrial production is estimated to rise some 60% in the next ten years. Looking at it another way, the prospective *increase* in manufacturing and mining is almost as large as the total output of just 12 years ago.

Crane announces Direction '70 . . . new products to help industry meet the challenge of the Soaring Sixties. These are products to improve quality control. These are products to increase production. These are products to help you control your costs. On the following pages is the first . . . the most significant Gate Valve improvement in 25 years. It's the first announcement of many you'll be seeing from Crane in Direction '70.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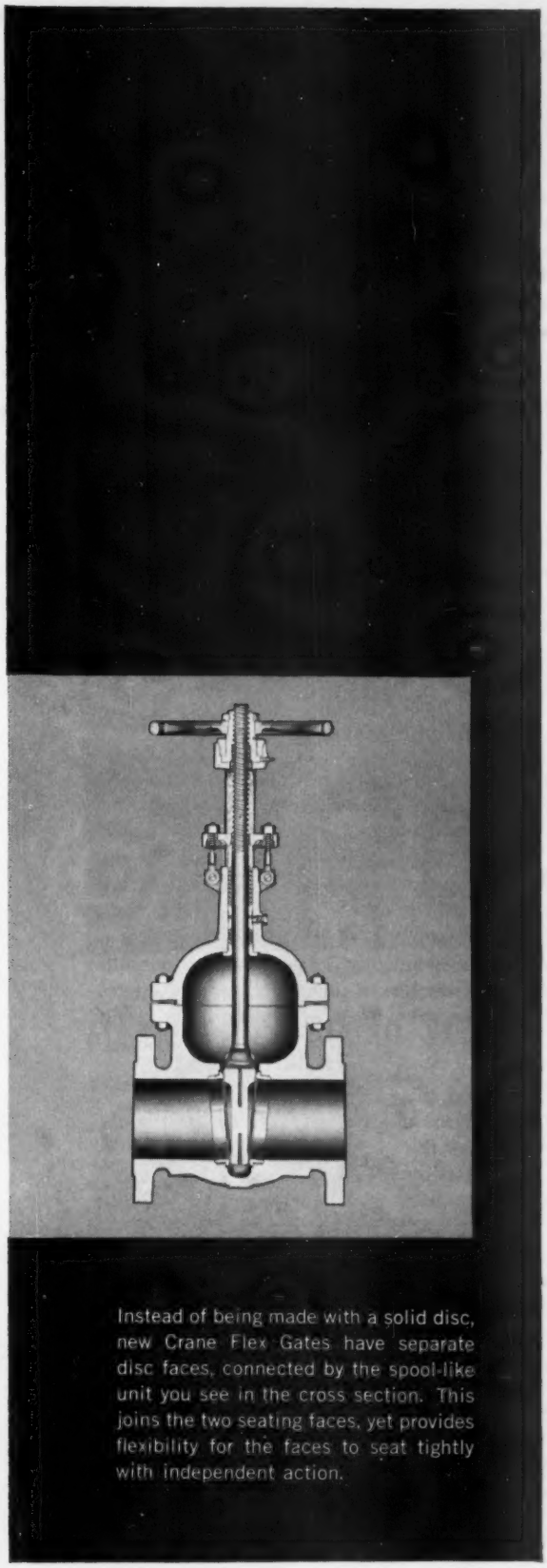

Instead of being made with a solid disc, new Crane Flex Gates have separate disc faces, connected by the spool-like unit you see in the cross section. This joins the two seating faces, yet provides flexibility for the faces to seat tightly with independent action.

FLEXIBILITY PROVIDES THESE BENEFITS

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates seat with less torque.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates unseat with less torque . . . will not stick closed even in high temperature service.

BECAUSE THEY'RE FLEXIBLE, minor deflection of seating faces due to pipe strains does not affect tightness of Crane Flex Gates.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates are tight on inlet seat and outlet seat over a wide range of pressures.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates can be used singly in some services where two conventional gate valves are frequently specified. You can save substantially on piping costs. And they have been exhaustively field tested.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates can be serviced—body seat rings replaced or seating faces refinished—quickly without painstaking accuracy. Slightly off-taper seats do not affect tightness or operating ease.

BECAUSE THEY'RE FLEXIBLE, new Crane Flex Gates will easily outperform any conventional solid wedge disc valve you now use. *And there's no increase in price.*

BECAUSE THEY'RE MADE BY CRANE, these new Flex Gates are completely dependable. You can use them with complete confidence on steam, water, gas, oil or oil vapor service. Stem and disc seating faces are Crane Exelloy. Shoulder-type body seat rings are Exelloy or Crane No. 49 Nickel Alloy. Sizes 12 inch and smaller; 150- and 300-pound pressure classes.

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Ask your nearby Crane Distributor for full information on Flex Gates—and for data whenever you work with the products Crane makes. He has the newest in information *and* products. Crane Co., Industrial Products Group, 4100 South Kedzie Avenue, Chicago 32, Illinois.

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The Readers' Guide

Standby Power and Emergency Lighting

(page 101)

The need for standby power and emergency lighting is a growing one – in spite of the constantly improving reliability of utility power services in most areas. But the subject of this month's special report is not popular, for it implies impending disaster. Thus, public concern with the problem usually is limited to the emotion charged period following such major tragedies as Boston's Coconut Grove fire. In fact, even New York City's serious power failure last September is almost completely forgotten, simply because it caused more inconvenience than catastrophe. Thus, the consulting engineer frequently is forced to fight a losing battle when he recommends standby power and emergency lighting for hospitals and other public buildings. In the chemical industry, and in communications, there is a definite economic basis for providing adequate standby power, hence these areas usually are well served. However, in spite of a growing body of legislation by the state and Federal governments, the public health and safety is still not adequately protected by auxiliary sources of electric power.

Liability Claims Growing

(page 98)

Until quite recently, consulting engineers were relegated to minor roles in the liability courts – the spotlight was more often on the contractor and the architect. But that is changing, according to C. S. Carstens, and the consulting engineer is unwillingly, and often unwittingly, being assigned a leading role. To a great degree, this is the result of the increasing complexity of engineering design. However, it is also the result of careless contract appraisal on the part of the consultant when he takes on the additional chores of construction supervision and approval of shop drawings.

Europe's Engineers Combine

(page 136)

This month CONSULTING ENGINEER offers another report from The Economist Intelligence Unit Ltd. It is a discerning study of how Western Europe's consultants have made use of the joint venture. While American consultants as a group can hardly hope to attain the legal status of a foundation, as does the Dutch "Nedeco" (Netherlands Engineering Consultants), they can surely get some ideas about developing business abroad from the many types of permanent and temporary alliances being formed in Europe for this purpose. Only British and Italian consultants seem to operate independently, as do American consultants, and they complain bitterly about the low fees of such combines as Nedeco. Economy of group operation may be the answer, for even Nedeco seeks profit.

Mapping the Moon

(page 120)

According to Donald R. Lueder, not much is really known about the moon. We have shown more interest in the distant galaxies, the spiral nebulae, and the boundaries of the universe. With the coming of the Space Age, all that must change, for the moon has become our next frontier. Thus, we – and also the Russians – are suddenly interested in mapping the moon. Lueder's firm presently is engaged in studying the feasibility of using photogrammetry and photographic interpretation to map the lunar surface from earthbound stations.

Books

(page 204)

CONSULTING ENGINEER devotes much space to both technical and nontechnical book reviews in the belief that, as a professional man, the consulting engineer must be equally interested in both. The nontechnical reviews cover novels by or about engineers, books of historical importance to the profession, biographies and autobiographies of its great men, or simply political and economic works which are of significance to the practice of consulting engineering. In addition, many important books covering the business aspects of private practice are reviewed. Photographs of the book itself, or of illustrations from it, now are being included with these reviews to help the reader select those of particular personal interest.

AUDIO NEWS
for consulting engineers

RADIO CITY MUSIC HALL: GREATER ENTERTAINMENT THROUGH CONTROLLED ACOUSTICS

Radio City Music Hall

Sound control booth showing compact mixer turrets

FLEXIBLE RCA SOUND SYSTEM FOR GOOD LISTENING, DRAMATIC EFFECTS

Like the staccato tapping of a Rockette routine which it serves to amplify, the RCA sound re-enforcement system in Radio City Music Hall is a triumph of precision planning and execution. The goal which RCA sound engineers sought to achieve in the original single channel installation of 1932 and which they have continued to strive for in the subsequent modifications of 1935 and 1955 has been a sound re-enforcement system in which every component is designed and positioned to most effectively exploit and enhance the natural acoustics of the auditorium.

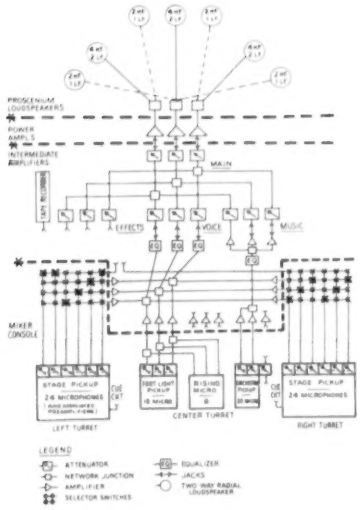
To achieve this goal a survey was made which attempted to analyze the total acoustic energy heard at any particular point in the auditorium. This study included an analysis of the acoustical characteristics of the auditorium – echo reflections, reverberant reflection, extraneous noise and distortion – and the optimum placement of the loudspeakers and microphones. The net result was precise knowledge and control of the degree and quality of sound which was being transmitted to every seat in the theatre, and a sound system capable of achieving "good listening" as well as brilliant and dramatic effects.

The present Radio City system was installed in 1955.

This system is of the three channel type to permit directional control and stereophonic effects depending on the requirements of a particular scene. There are a total of eighty-nine microphones positioned about the stage, footlights and orchestra. These are patched and mixed at the console which is housed in the sound control booth, a compact open-fronted box located to the left of the film projection booth, high above the audience. For ease of control, the individual mixers for the microphones are banked in left, center and right turrets; each turret also contains six sub-master mixers which may be mechanically ganged in "pairs" or "threes" when desired.

An equipment room, adjacent to the sound control booth, houses the amplifiers for the system. Each sound channel is powered with two 35 watt theatre type amplifiers. The amplifiers are designed for rapid servicing. A meter on the case of each amplifier indicates condition of the amplifier, eliminating the necessity of trial and error testing. Also the amplifiers can be serviced from the front.

AUDIO NEWS for consulting engineers

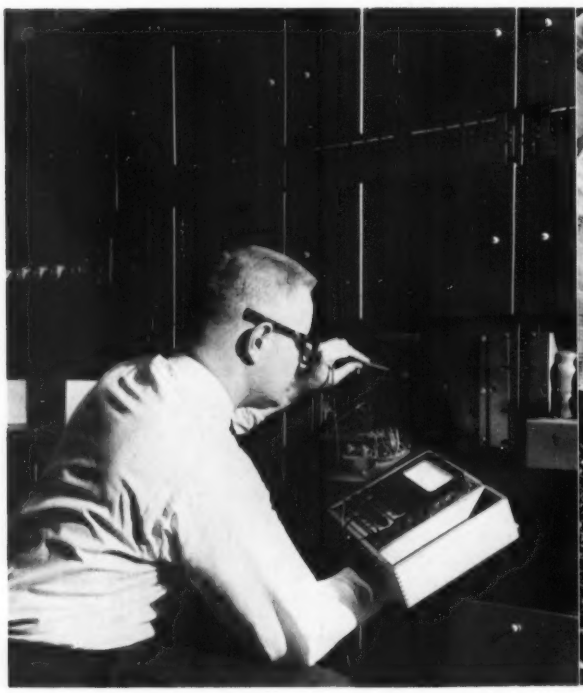


Line diagram of Radio City Music Hall sound reenforcement system

The proscenium arch has been employed to house the loudspeaker systems. Seven theatre type two-way radial horn loudspeaker systems are hidden behind the lighting grilles in the proscenium wall. Arranged to achieve maximum flexibility and effectiveness, three of these systems are connected to the center sound channel for full coverage of the auditorium while two systems are connected to each side channel for directional effects.

A total of twenty HF and ten LF drivers are used in the complete system. The total audio power of the system is 280 watts which frequently is fully utilized for sound effect purpose.

The success of the Radio City Music Hall sound re-enforcement system can be attributed to precise planning and analyses which went into the original installation and which have continued with the succeeding modifications. Relatively few sound re-enforcement systems are critical enough to require special acoustical analyses. But for those installations that *do* require acoustical perfection, we will be glad to have our acoustical consultant work closely with you and your client in planning an audio system which will enhance your reputation, and ours.



Mr. Warren Jenkins Radio City Music Hall sound director checks equipment in amplifier room

Seven loudspeaker systems contained in proscenium arch

RCA Tmk(s) ®

RADIO CORPORATION of AMERICA

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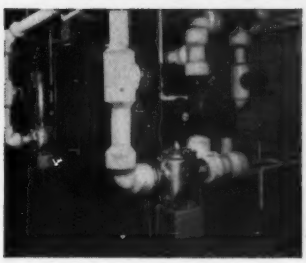

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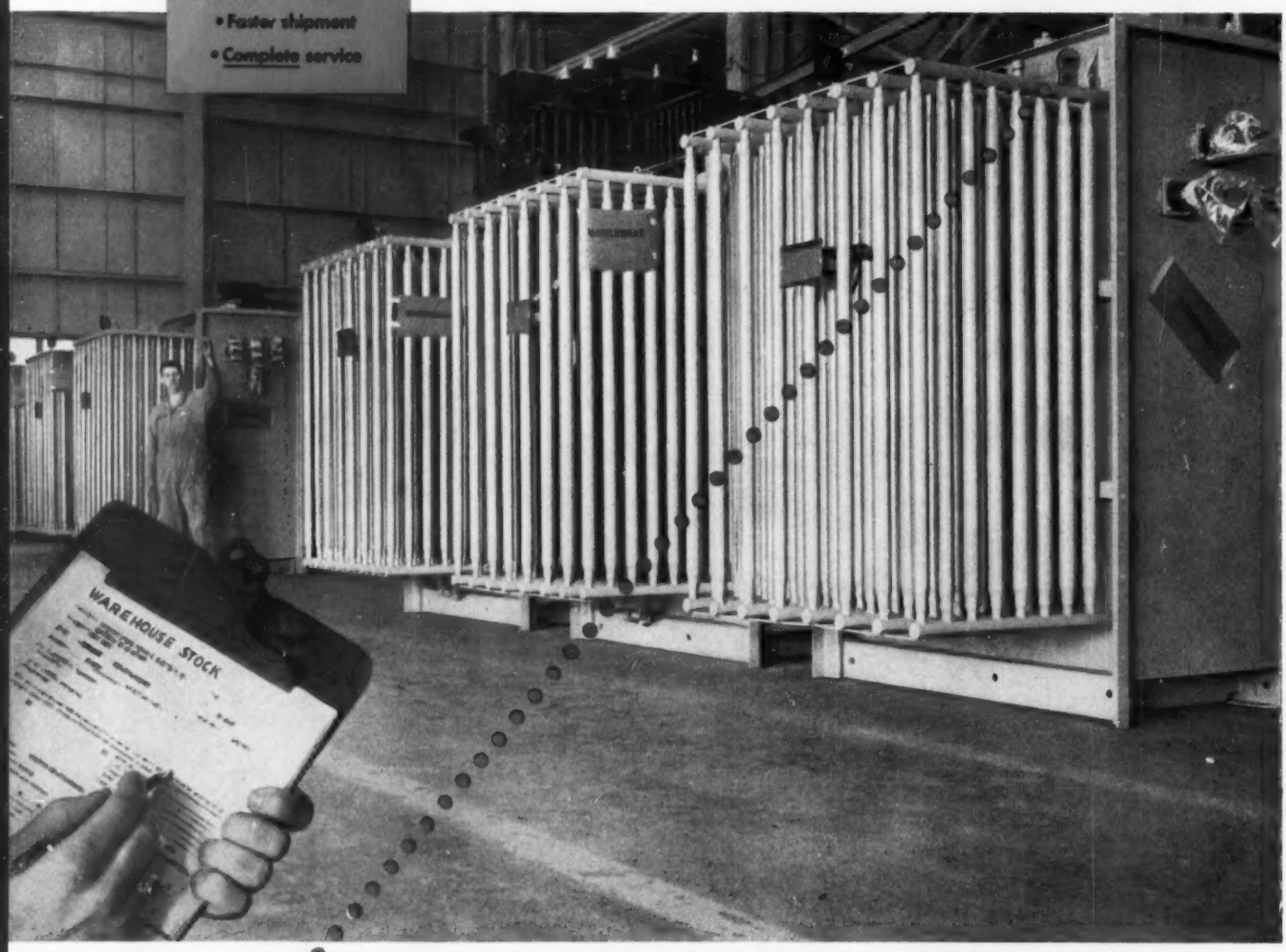

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Faster shipment is typical of the many benefits available with General Electric's Certified Full-value transformers. For full data contact your G-E Apparatus Sales Engineer or Agent. General Electric Co., Schenectady 5, N. Y. 417-10

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STACKER-TYPE construction features wound core for more efficient transformer.

STURDY CONSTRUCTION makes three-legged design well suited for industrial use.

TWO DESIGNS of Distribution Equipment Transformers are available, conventional three-legged (left) and stacker-type.

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GENERAL ELECTRIC

NIGHT-DAY

6 AMERICANS WORK AROUND THE CLOCK ON NORTH AMERICA'S BIGGEST POWER PROJECT

WORK NEVER STOPS on the gigantic $720,000,000 Niagara Power Project—largest hydro-electric development in the Western Hemisphere. Consulting engineers are Uhl, Hall & Rich of Boston.

Five big American Revolvers work at three levels on Merritt-Chapman & Scott's $98,800,000 contract for the main Niagara Generating Plant. By day they handle material, set forms—at night, pour concrete. 1,200,000 cubic yards of concrete and 42,000 tons of steel go into this structure alone!

American's work-horse dependability is essential on projects like this where equipment failure or poor performance can slow down work, foul up schedules. Consulting engineers and contractors know that top-rated, tough American Cranes keep jobs on schedule.

Write for detailed, illustrated information on the complete line of American equipment specially engineered for a wide range of construction and materials handling duties.

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and Derrick Company
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DERRICKS-HOISTS
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Direct-drive DeBOTHEZAT Bifurcator Fans economize fume removal problems in a wide variety of applications. Contact a DeBOTHEZAT engineer NOW, or write Dept. COE-660.

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The Word From Washington

EDGAR A. POE, Consulting Engineer Correspondent

CONSULTING ENGINEERS may criticize the ethics of the U-2 incident and similar projects, but at $2500 a month the pay for this type of aerial mapping seems satisfactorily above the recommended minimum of current fee schedules.

Investments Abroad

State Department records show United States direct investment abroad, including new investment and reinvested earnings, averaged about $2.4 billion a year for the 1955-58 period. Historically the investments have been heavily concentrated in Europe, Canada, and Latin America. Approximately $100 million a year has been going to the less developed areas of Asia, Africa, and the Middle East. All too high a share of this has been in petroleum. Other industrial investments are far behind.

Favorable Reaction

House and Senate Appropriations Committees apparently have a new respect for consulting engineers. Both Committees printed the subcommittee testimony of Ralph Westcott, of Los Angeles, the retiring president of the Consulting Engineers Council.

In his appearance before the House Committee, Representative Ben F. Jensen, gave consulting engineers a warm pat on their professional backs. The Iowa Republican declared that he favored greater use of consultants in the Federal government. However, he expressed the conviction that the nation's security demanded that the U. S. Army Corps of Engineers should be maintained, particularly in troubled times.

With Representative Louis C. Rabaut, Democrat of Michigan, presiding, Westcott concurred with Representative Jensen on the importance of maintaining the Army Engineers. At the same time Westcott pointed out emphatically that consultants, too, form a great reservoir of engineering talent having twice been called upon during a 20-year period to augment the staffs of the Army Engineers in wartime. He said the nation would be the loser if this reservoir of talent were not maintained down through the years.

Westcott was accompanied during his appearances before the two committees by L. K. Crawford, consulting engineer with headquarters at Springfield, Illinois.

Later, testifying before the Senate Committee presided over by Senator Allen J. Ellender, of Louisiana, Westcott said that consultants represent a reservoir of talent available to both government and industry. The Californian told the Senate group that he feared that if the philosophy of using private engineering firms were eliminated by departments of the government having engineering problems involving design of engineering projects, this eventually would lead to elimination of a whole segment of the free enterprise system.

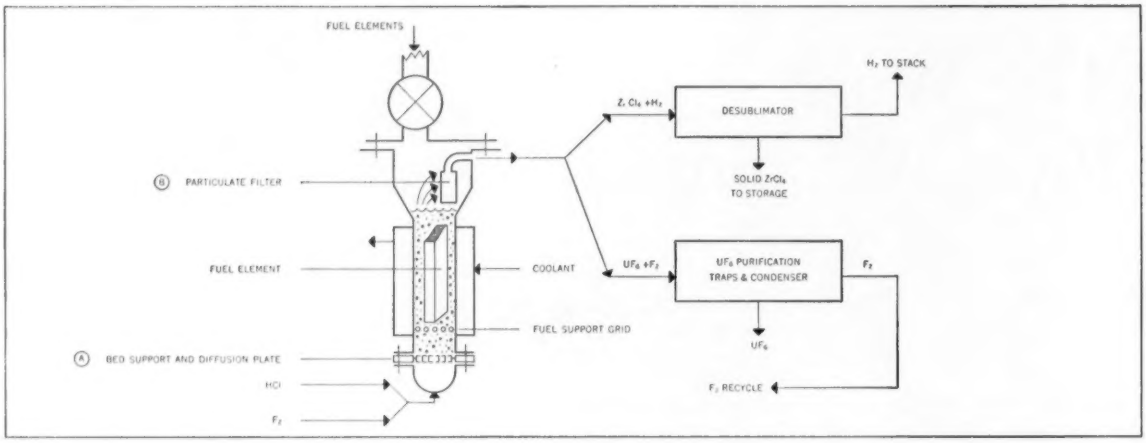
Senator Ellender asserted that his committee is concerned primarily with problems and projects handled by the Army Engineers, and since the Corps of Engineers employs the services of private consultants, he was glad the witness brought the matter before his Senate Committee.

Senator Warren G. Magnuson, Democrat of Washington State, a member of the Appropriations Committee, said he favored using consulting engineer firms in connection with Federal projects.

Study Multilateral Assistance

After limited operations in Latin America, the United States 10 years ago started a world-wide technical assistance program. The size of the program has been growing as the scope of activities broadened. In a report to Congress President Eisenhower said the program today affects 60 countries and territories. Such diverse fields as agriculture, education, labor, communication, transportation, and community development is involved.

During the same period the United Nations and its several specialized agencies, the Organization of American States, and other multilateral institutions also have embarked on a major program of technical assistance. A number of other governments, several foundations, and some business organi-



$$Zr + 4HCl \rightarrow ZrCl_4 + 2H_2$$
$$U + 3F_2 \rightarrow UF_6$$

. . . and it wouldn't be possible without the Purolator filter that helps cut nuclear fuel reprocessing time from 24 hours to 1½

The latest achievement in reducing the prohibitive fuel-cycle costs of nuclear energy is a fluidized bed halogenation process that provides clean separation of uranium from a zirconium-uranium fuel element. This new process, a big improvement on conventional gas phase volatility processes, was developed at Brookhaven National Laboratory. It would not be operable without two Purolator developments: an Inconel metal-edge distributor plate, A, which is faced on both sides with porous metal; and an Inconel frameless metal edge filter, B, which is faced on the outside with porous metal.

The principal advantage of the fluidized bed technique is its speed in recovering uranium from spent fuel elements. The standard gas phase process takes 24 hours; with a fluidized bed, recovery time is cut to 1½ hours, and the reaction is more uniform and more easily controlled, too.

To operate the Brookhaven pilot plant, a 10" section of spent fuel element is submerged in a mass of inert granular material that is suspended in a mobile, or fluidized, state, by introducing hydrogen chloride gas at suitable velocity at the bottom of the reactor vessel. The Purolator-designed diffuser plate assures complete dispersion of the HCl through the granular bed. Inconel, a porous metal, is used to face the top and bottom surfaces of the plate, to resist the corrosion and the reaction temperature of the fluidized bed, which ranges from 400-450°C.

By creating a reaction in a fluidized bed, coefficients of heat transfer as high as 400 Btu/Hr x Ft² x °F have been observed, with corresponding reaction rates up to 6000 mg per cm²/hr, much higher than could be achieved if gas were the sole coolant. The upward velocity of the gas required to sustain the bed in a fluidized state tends to raise minute particles of uranium above the bed. The metal-edge Purolator filter effectively screens these particles to prevent their loss. The filter that Purolator designed for the Brookhaven installation is composed of a continuous Inconel spiral with integral risers, coated with a thin facing of Inconel which ensures an average filtration of 1 micron.

Performance to date has been so successful that the Brookhaven team plans to build a pilot plant halogenator to conduct complete hydrochlorination and fluorination reactions on full-scale fuel elements. The full-scale production unit will incorporate six Purolator Inconel filters. In addition, because of its corrosion resistance, Inconel will be used as construction material for the halogenator vessel, instead of the present stainless steel.

Presumably you don't have the problem we've just described, but it is a good case in point that Purolator can filter anything that flows. And if your problem (whatever it is) could conceivably involve a filter or a separator, Purolator can help you. Our address: Purolator Products, Inc., Dept. 2683, Rahway, New Jersey.

Filtration for Every Known Fluid **PUROLATOR**

PRODUCTS, INC.

RAHWAY, NEW JERSEY, AND TORONTO, ONTARIO, CANADA

zations are providing technical help to underdeveloped countries.

For the 1960 fiscal year Congress appropriated $181 million for multilateral assistance programs. In his report President Eisenhower tossed out the question of whether the technical assistance program should receive greater emphasis and if it would be significantly increased in size in the years ahead. Should more stress be placed on a few selected fields, such as health, education, industry, or transportation? Or is technical assistance essential in a great variety of fields?

Because of the need for concrete answers to a wide range of questions involving technical aid, the International Cooperation Administration plans to launch a comprehensive study of the entire subject of technical assistance. The 18-month study will be conducted as a research project. It would do no harm for ICA to consult with and make full use of consulting engineers in this study.

Public Power Policy

Secretary of Interior Fred A. Seaton not only outlined the public power policy of the Eisenhower Administration, but apparently set the pace for the Republican Platform Committee at this year's big quadrennial Republican National Convention. Addressing the American Public Power Association convention in the nation's capitol, the Cabinet Officer said:

"I shall continue to support the right of any state to make its own choice and, consistent with state law, for the right of any locality to itself decide whether it wants public or private or Federal power. But I will not support the fallacious and dangerous proposition that the Federal government has a 'public utility' responsibility. The inevitable end result would be a Federal monopoly and a complete lack of local determination and control.

"In the public power field, as in all other areas, the proper function of the Federal government is to do only that which must be done in the national interest and then only when non-Federal monopoly cannot or will not do it."

Impact of the Space Program

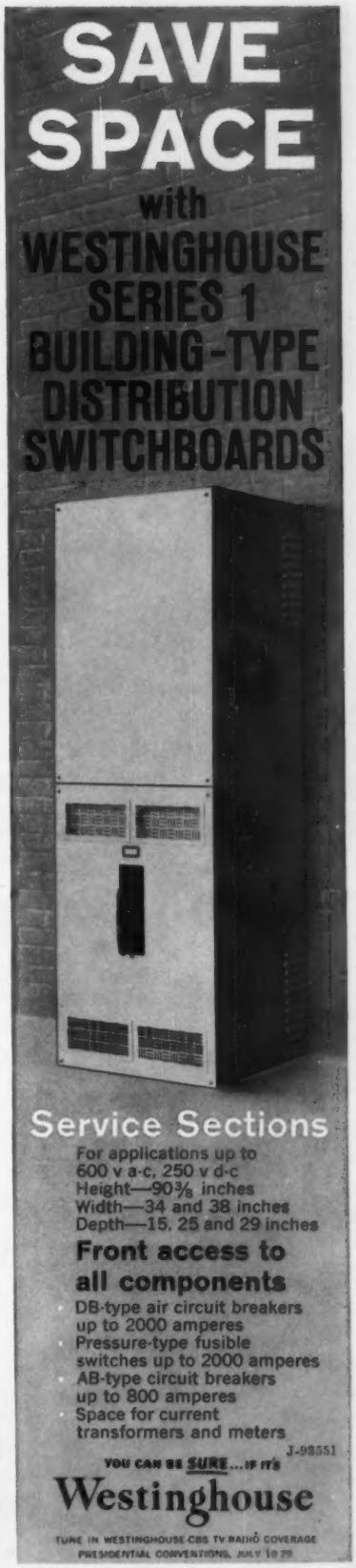
Space equipment and electronics are now wedded and are expected to produce some wonder children in the aerospace era ahead, but they will be expensive. Expenditures of billions already have been blueprinted, and it is estimated that electronics business will be the nation's largest in 10 years.

There was substantial debate on the national space program at the closing session of the 86th Congress and before the Space Committees headed by Senator Lyndon B. Johnson and Representative Overton Brooks. Johnson and Brooks said their committees have been working closely with Dr. T. Keith Glenna, administrator of the Civilian Space Agency, and with industry leaders. It is estimated that about 50 percent of the electronic industry's activity is currently devoted to government projects. Some estimates place current fiscal year expenditures on government and defense jobs at around $5 billion.

After long hearings before his committee, Representative Brooks pointed out that people have been dreaming for centuries of space travel. Now that means are available to make the dream come true, there are grave doubts in the minds of many people about its value.

"The value of our space program is both psychological and military, in the cold war and the hot war alike, and could be amply justified on either grounds," said Representative Brooks. "If you happen to be a teacher or a housewife, it may be hard to think of outer space as something that affects you. Yet it does just this; and sooner or later a lot of our prosperity as well as our national security is going to be wrapped up in outer space.

"We can look forward to better and cheaper methods of radio communication, weather forecasting,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Service Sections
For applications up to 600 v a-c, 250 v d-c
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Depth—15, 25 and 29 inches
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Zero leakage nuclear pumps

Four BJ Liner-Motor Pumps Provide Primary Cooling for AEC's SPERT-III Project

High temperature, high pressure and high capacity performance *with zero leakage* are demanded of these four Byron Jackson Liner-Motor Pumps. Employed to handle pressurized water for primary coolant at the Atomic Energy Commission's SPERT-III project near Idaho Falls, the 500 HP pumps are operating at 650° F, 2500 psig, and are rated at 5000 GPM with a total dynamic head of 350 feet.

In building pumps to such critical requirements, BJ calls upon the engineering skills and manufacturing methods that have made Byron Jackson a leader in nuclear pumps for all types of reactors...stationary, or portable. The success of BJ nuclear pump design is proved through the installation or specification of BJ Pumps on practically every major commercial reactor in the United States.

BJ quality *does* cost less in the long run!

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and navigation by means of satellites. Already new developments in treating diseases and in analyzing the human anatomy, which will have a direct effect upon human beings, are being developed in our space program. New space exploration may unlock the ancient secrets about the origin and use of the solar system and even of life itself.

"Admittedly, such wonders lie in the future. Yet I expect to see some of them myself in the next 10 years or so. At present, space exploration is first and foremost a new means of scientific research. Naturally, this aspect appeals to the scientific community, both at home and abroad. It is only the beginning."

Some of our foremost electronic experts forecast that nearly all of our billions appropriated by Congress in the immediate years ahead will be earmarked for vehicles that will operate within 25,000 miles of the earth.

It is within this radius, they declare, that is offered the most space age miracles in world-wide communications. The world's communications bands are presently overworked. They point out that the electronic spectrum is accommodating millions of pieces of transmitting and receiving equipment.

Foreign Financing

The president of the World Bank, Eugene R. Black, asserts that "scientific and technical knowledge is power; that all exercise of power in international affairs — and economic aid is one such exercise — involves inevitably great moral and political hazards. But not to exercise this power clearly involves even greater hazards; it amounts to saying that this knowledge has no enduring worth . . . or to saying that the free nations of the world have lost the courage to use the great power of their knowledge to help others live in freedom."

President Black said that the International Development Association, a development financing institution, will come into being this fall. He expressed confidence that IDA will make possible further growth in the technical assistance work of the Bank. At the same time he said there is a tendency to downgrade IDA before it even begins operations on the ground that the initial funds at IDA's disposal are too small . . . However, resources of the IDA are expected to increase when member countries find it is advisable.

"There are advantages in not starting on too large a scale," said Black. "Emphasis on huge global investment targets can be both misleading and disillusioning. What matters is not only the quantity of investment but its quality."

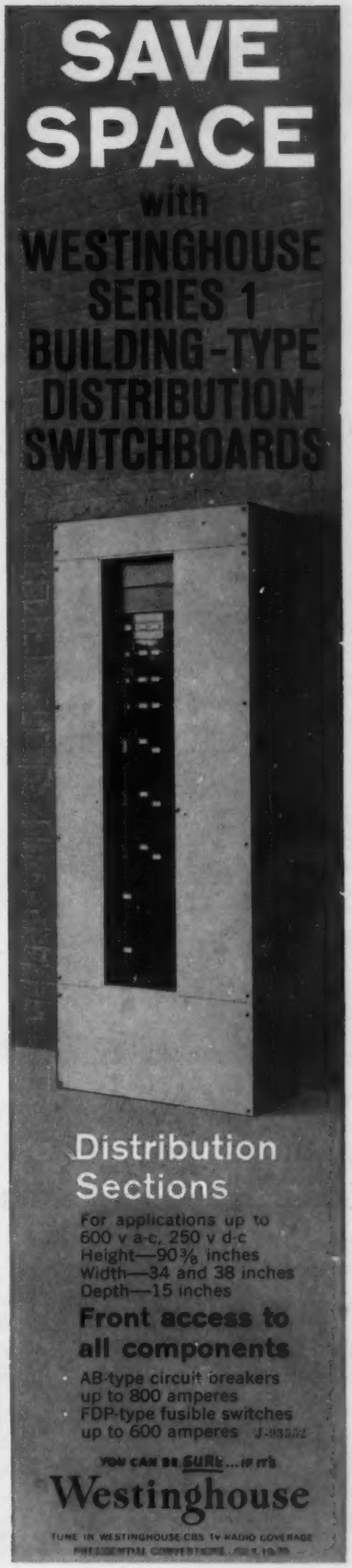
International Development Association is not the only new international financial institution now being set up. The Inter-American Bank is getting ready to assist in the growth of the economies of Latin America. All 20 Latin American countries are now recipients of technical assistance under the mutual Security Program.

Meantime, India, overpopulated and undernourished, is the World Bank's biggest borrower. More than a half billion of the bank's dollars have been invested in India.

Wants Air Pollution Control

Congress seems more and more interested in air pollution control. Senator Kuchel, an advocate of larger Federal appropriations for air pollution work, rose on the Senate floor to declare that air pollution is not a temporary problem but one which is almost certain to require continuing attention in the interest of public health, safety, and comfort.

With smog a health hazard to many of his constituents, the Westerner is advocating the empowering of Federal agencies and officials with broad authority to assemble and make use of all the resources of the government for comprehensive studies, investigations, and ex-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Distribution Sections
For applications up to 600 v a-c, 250 v d-c
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Front access to all components
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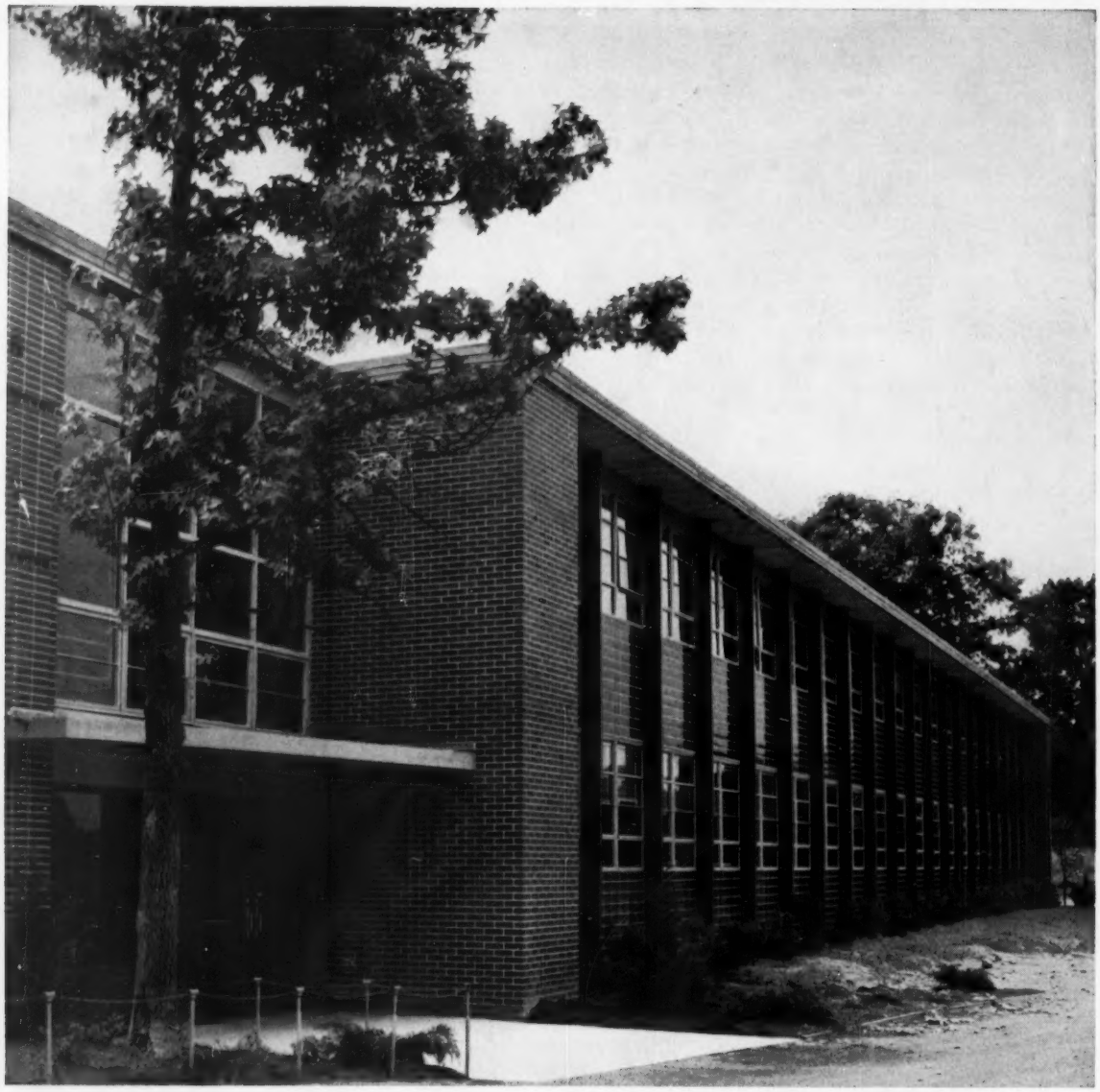


Why so many Birmingham schools heat with LO-BLAST GAS burners

"With the style of architecture we want here in Birmingham, we find that it's more practical to have small gas-fired boilers in each school building rather than build a central plant and pipe heat to each building," says Mr. Fred J. Kelley, Business Manager of the City Board of Education.

"That's one of the reasons why we specified Lo-Blast Power Gas burners for many of our new schools. These units adapt most easily to the boilers we use. What's more, they have a very good record here in Birmingham for safe, consistent performance plus low-cost installation and operation."

Gas heating can give your schools safe, economical service—especially with the new Lo-Blast burners made by Mid-Continent Metal Products. For complete information, check with your local gas company's Heating Specialist, or write Mid-Continent Metal Products Co., 1960 N. Clybourn Ave., Chicago 14, Illinois.

AMERICAN GAS ASSOCIATION

Economite and Lo-Blast Power Gas Burners operate silently, cost less to install, are well suited for down-draft boilers, and are available in capacities from 70,000 to 20,000,000 BTU.

FOR HEATING ... GAS IS GOOD BUSINESS!

periments to find means not only for curbing but eventually eliminating polluted air from American cities. Rather a big order.

Downtown Rehabilition

With the United States becoming more urban each day, the great central cities are having the fight of their lives to remain centers of trade, commerce, industry, transportation, and culture. As a result both major political parties are likely to insert a plank in their platforms calling for concerted action designed to curb the blight and deterioration of our older cities. The decaying central business areas are no longer able to compete with the suburban shopping districts.

Russian Translations

The Instrument Society of America's program to translate important technical journals of the Soviet Union as an aid to engineers and scientists of our country is being supported financially by the National Bureau of Standards and the National Science Foundation. It is hoped, however, that the *Journal of Translation* will become self-supporting through subscriptions ($20 per year for six issues).

The first year of the publication providing engineers and scientists with information on Russian activities in the measurement sciences, is now available from the Instrument Society offices at 313 Sixth Avenue, Pittsburgh 22, Pennsylvania. The half dozen issues available carry a series of articles dealing with problems in linear, mechanical, electrical, and radio measurements, plus reviews, essays, and dissertations on the Soviet Union's standards, measures, and measuring instruments.

The Glen Canyon Picture

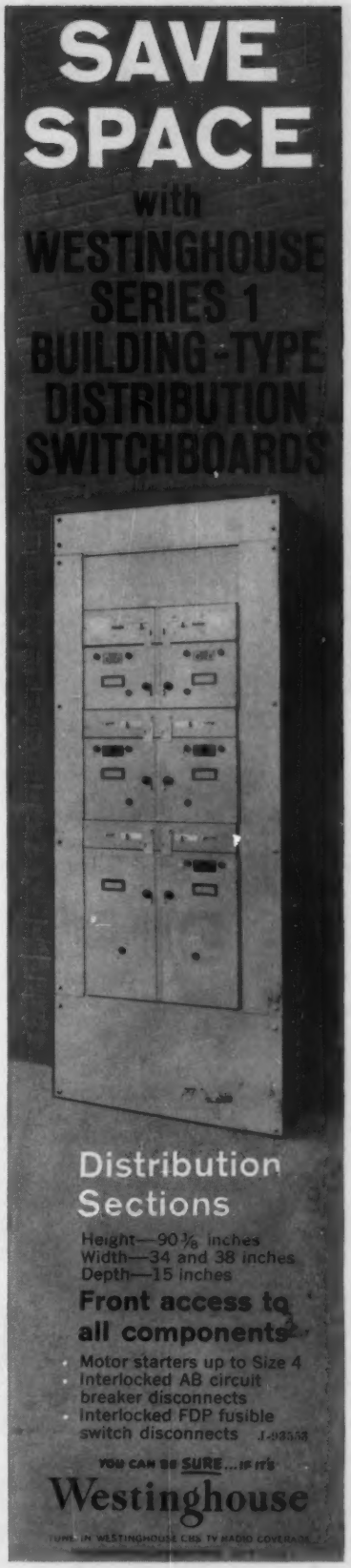
Full scale concreting operations were initiated in mid-June on a new phase of construction of the great Glen Canyon dam site, on the Colorado River, in Northern Arizona. Four years from now the 700-ft high multipurpose barrier is scheduled to be completed. It will create a 186-mile long lake.

From a standpoint of funds expended, the $183 million project already is considered complete although there is little evidence as yet of any actual structure rising from the excavation in the depths of the 700-ft canyon. The Bureau of Reclamation said that total cost of the dam, with power plant, switch yard, and appurtenant features, will involve an outlay of $324 million. Placement of concrete will signal the start of a long haul trucking job which is believed to be unequaled in construction history. Approximately 3 million barrels of cement will be supplied from a plant at Clarksdale, Arizona.

Total truck miles for this haul have been calculated by DUD (Department of Useless Data) to be 137 million miles. During the peak construction period of about three years, an especially constructed cement truck rig, 60-ft long and carrying 27¾ tons, will leave Clarksdale on the 376-mile round-trip every 30 to 40 minutes.

Picketing Problems

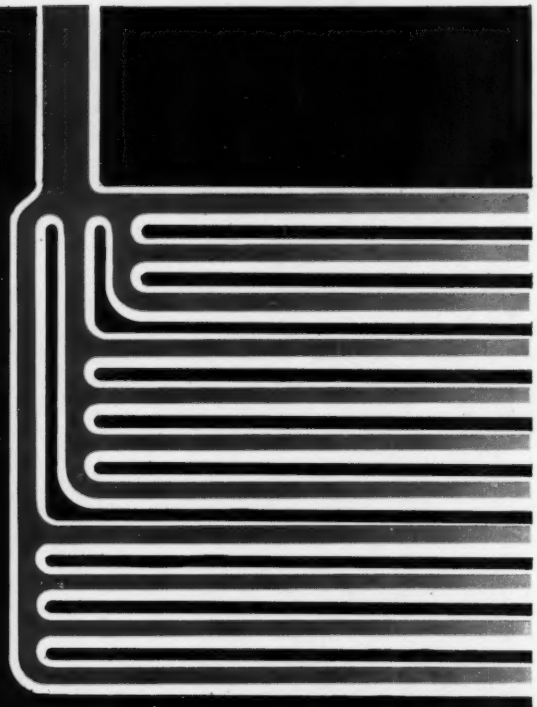
Representative Phil Landrum, Democrat of Georgia, co-author of the Labor Reform Act of 1959, has branded the Thompson "Secondary Boycott" Bill (HR 9070) one of the most vicious pieces of class legislation which he has seen since coming to Congress. The bill, approved by the House Labor Committee, would permit so-called common situs picketing in the building and construction industry. Thus, a strike against any one of a number of subcontractors could result in picketing at the job site which might close down the whole construction job. NSPE also has gone on record against this bill, because in all probability it would bring undue union pressure upon employees of engineering and surveying firms in the construction industry. ▲▲



NEW MULTI-ZONE

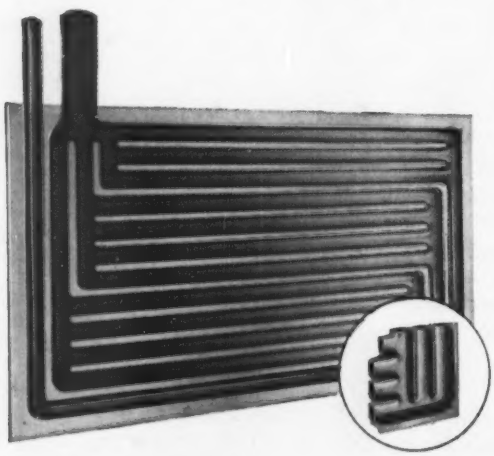
PLATECOIL®

IS AN EXCLUSIVE TRANTER ADVANCEMENT IN HEAT TRANSFER TECHNOLOGY



The new MULTI-ZONE PLATECOIL introduces a new principle of coil design. The multiple header, multiple return pass arrangement produces FREE-FLO action. Steam is distributed to all levels of the coil almost instantaneously. This new design overcomes the problem of condensate "trapping" — a disadvantage of common pipe coils and single-headered units—that robs effective heat transfer area. Only TRANTER PLATECOIL offers the extra capacity of MULTI-ZONE heat distribution.

MULTI-ZONE PERFORMANCE SOLVES TOUGH TANK AND PROCESS HEATING PROBLEMS



Better steam distribution provides a reserve capacity for heat transfer to overcome overload conditions which drop tank and process vessel temperatures. Heat-up time after tank or processing equipment shut-down is cut to a minimum. Tank temperatures are maintained within closer limits and production is improved.

More effective heat transfer area and more heat transfer per square foot of area makes it possible to use fewer and more compact PLATECOIL units than is possible with other types of equipment. Valuable tank space is saved and the need for addition of new tanks to get higher production is often eliminated.

Add to these performance advantages, low cost of installation and operation, economical maintenance and scientific engineering for the best answer to your heat transfer problems.

Write for NEW Bulletin PB5 for complete data.

Tranter Manufacturing, Inc.

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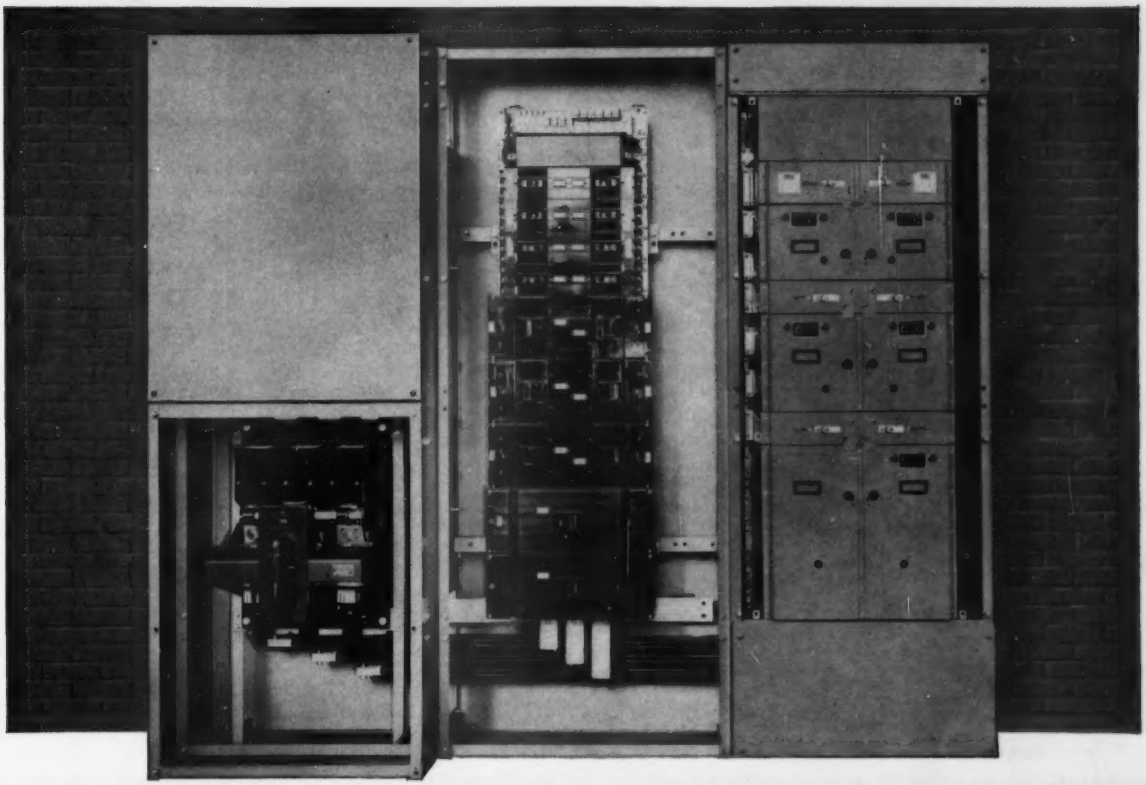

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Designed for commercial buildings, Series 1 has been standardized for flexibility and low installed cost. Adequate wiring space has been reserved at top and bottom of each structure for incoming and outgoing cables. Series 1 may be installed against any wall where floor space is at a premium, since all components are accessible from the front. Additional distribution sections may be added later as dictated by increasing loads. Each distribution section measures only 15 inches deep. All sections are attractively designed and finished in gray lacquer to provide a pleasing appearance.

For more details and layout information, contact our sales office near you or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. Ask for Publication SA-8667. J-93554

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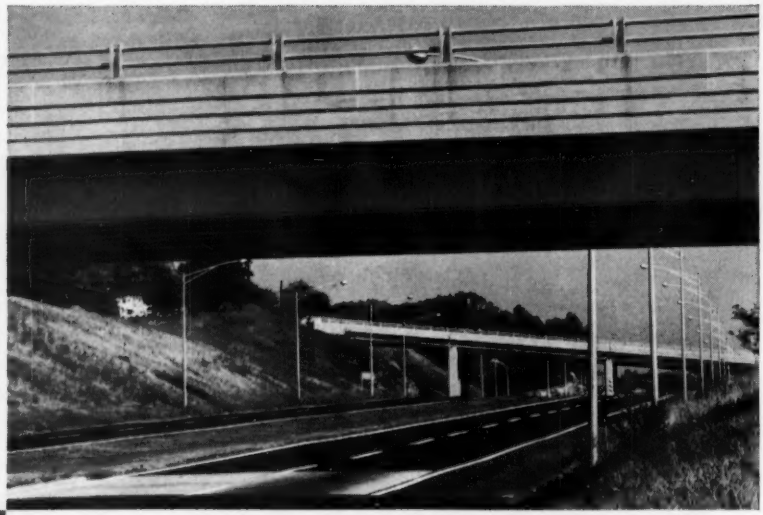
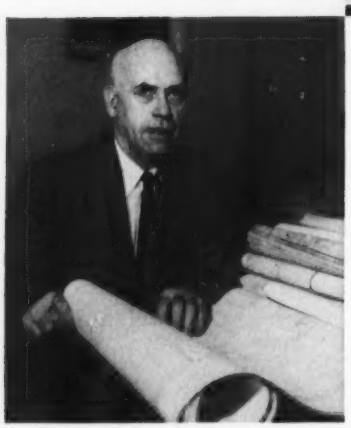
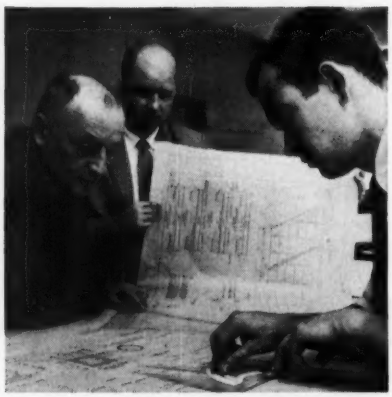
Keep our roads on the GO



Steel construction offers adequate clearance and reduces height of approaches.



Mr. Harold S. Woodward, partner, Seelye, Stevenson, Value and Knecht, agrees that nothing is easier to design with than steel.



Mr. Williams D. Bailey, partner of the firm (left) supervises steel designs with his assistant, Mr. R. F. Shumaker (center), and Mr. Melvin Leonard.

Short-span steel bridge over the Connecticut Turnpike. Simple design saves engineering time and erection costs.

Steel specified in over 95% of short-span bridge designs

at Seelye, Stevenson, Value & Knecht, Consulting Engineers, New York, N.Y.

The Bridge and Highway Division of this engineering firm deals almost exclusively in the design of short-span bridges from 100 to 125 feet long. In the past few years, the firm has designed bridges for the New York Thruway, the Connecticut Turnpike, and large projects in Ohio and Virginia. More than 95% of these bridge plans specify steel construction, according to Mr. Harold S. Woodward, partner in the firm.

Reasons for favoring steel construction. There is nothing easier to design with than steel . . . it takes only a fraction of the time for the designers to draw their plans, because considerably fewer mathematical calculations are required. If changes have to be made, it is relatively simple with steel design. With some other forms of construction, any changes may mean redesigning the entire structure—a costly waste of professional manpower.

Steel is available. This factor deserves serious consideration on any job. Steel is readily available and can be transported quickly and simply to the job.

Steel goes up quickly. Bridge spans must be constructed with least interference to traffic. The speed with which steel can be erected without normal traffic interruption is a big advantage.

Steel permits maximum headroom—also, minimum approach alteration. According to Mr. Williams Bailey, another partner in the firm, the use of slender steel beams keeps overpass approaches at a minimum in congested areas, and makes it possible to allow for tight clearances with minimum disturbance to established roads and buildings.

Steel reduces costs. Light construction with steel reduces foundation costs, and faster erection saves labor. New high-strength steels offer greater strength with even less bulk.

United States Steel and the steel industry in general have greatly *expanded facilities* for manufacture of structural shapes and plates. You can confidently design in steel—the material you know best, and the material that offers most—knowing it will be available. *USS is a registered trademark*

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
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United States Steel Export Company

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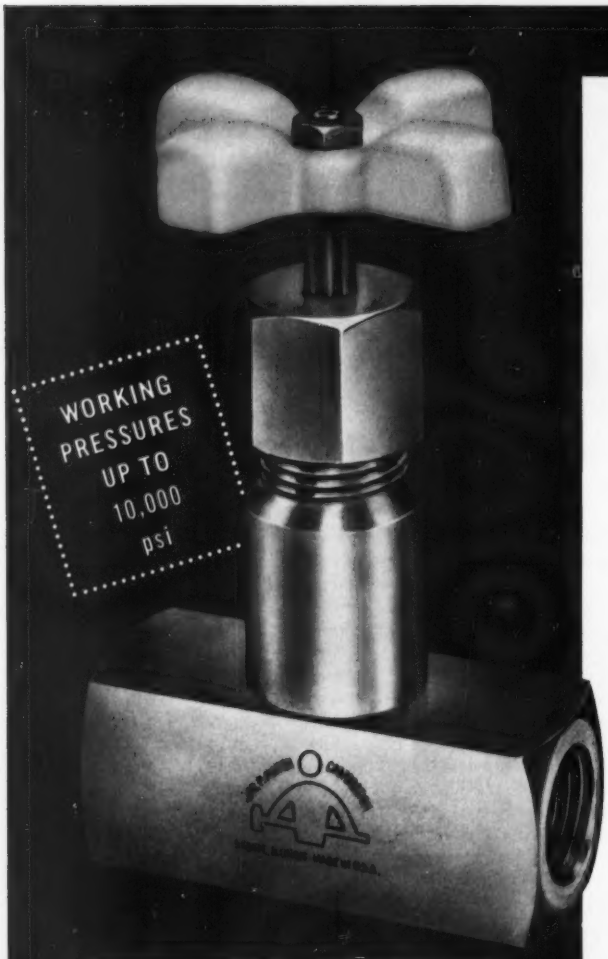


Know it by the yellow handle

Use it because it embodies features never before combined in a needle throttling valve . . .

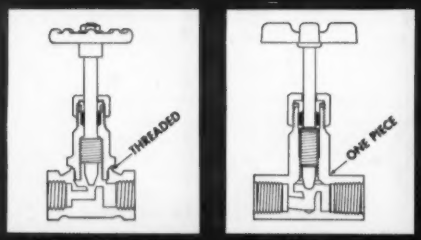
It is the first throttling and shut off valve that serves the whole range of pressures—from low to 10,000 psi—with equal efficiency all the way through.

It is the valve in which body and stem guide are one piece—completely fused into an integral leak-proof unit by the exclusive Marsh "Conoweld" process.

It is the valve in which the stem is precision machined and ground. Perfect stem alignment and fine threads provide easy and precise throttling. Special "Marpak" packing always holds tight; never binds.

Bodies of the 1900 series identified by the yellow handle are machined from high grade carbon steel bar stock marked in accordance with M.S.S. regulations showing size, material and service. Stems are 416 stainless steel. Valves are available in the patterns shown below; sizes ⅛", ¼", ⅜", ½", ¾" and 1".

Marsh Needle Valves are also available in 416 stainless steel throughout (identified by green handles). *Write for bulletins.*



Conventional Construction — **Marsh Construction**

In conventional valve (left) stem-guide is threaded into body . . . can be backed out when valve is fully opened, causing real trouble when pressure is high. Can't happen with Marsh design (right). Marsh stem-guide is welded to body.

MARSH INSTRUMENT COMPANY, Dept. ** Skokie, Ill.
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MARSH

SERIES 1900

Needle Valves

The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

Conditions of the Contract: Assignment and Subcontracting

LAST MONTH we began a comparison of the "Conditions of the Contract" forms of the Consulting Engineers Council (CEC) and of the International Federation of Consulting Engineers (FIDIC), and we considered the role of the engineer, under these two contract forms. Here, we consider assignment and subcontracting.

Assignment of the Contract

Both forms contain provisions prohibiting assignment of the contract except under certain conditions, but these provisions differ significantly. The International form (Sec. 3) says that the contractor "shall not assign the contract or any part thereof or any benefit or interest therein or thereunder" (except by discounting sums due or to become due with the contractor's banker), without written consent of the owner. The CEC form (Sec. 2.3.11) says that neither the contractor nor the owner shall assign any interest or obligation under the contract, without the written consent of the other party. No exception is made for discounting with the contractor's banker.

Aside from the difference as to the parties bound and the exception as to discounting, there also appears to be a further difference in the meaning of the word "assign" as used in these two forms. Unfortunately, "assign" also is used in two different senses in the law of contracts. In one sense, "to assign" a contract means to assign one's rights under the contract. In another more ambiguous sense, the word may mean either the assignment of rights, or the delegation of duties or obligations under the contract, or both. It is never possible unilaterally to assign duties or obligations in such a way as to be rid of them; at most, one can delegate the duty of performance to another while still being personally liable for the performance. Therefore, it is always a source of confusion to refer to the assignment of obligations.

Difference in Approach

The International form (Sec. 3) appears to be limited to assignments of rights (although the language is not absolutely clear on this). The delegation of duties by the contractor is treated separately in Sec. 4 of the International form, which refers to subletting the whole or part of his duties.

On the other hand, the CEC form refers to assignment of both rights and obligations in a single clause, limiting both the owner and the contractor. This certainly means that neither the owner nor the contractor can delegate performance of his obligations to another person without the written consent of the opposite party. As to delegation of the contractor's obligations, this is clearly in accord with the CEC section (2.3.19) on subcontracts. But it certainly seems strange to say that the owner cannot delegate the performance of his obligation to someone else, when the only obligation he has which requires any affirmative performance is the payment of money! His only other obligation (Sec. 2.3.08) is to provide the lands on which the work is to be done and which are required for access; if the CEC form is taken literally, it would imply that the owner could not sell the land during the construction work since then he could not guarantee access to the site. Furthermore, the owner's principal right in the contract is to have the work completed, and the CEC form distinctly says that he cannot assign such right. Therefore, there seems to be no way of escaping the conclusion that the CEC form prohibits the owner from selling the land during the existence of the contract.

Intent Questionable

If this is so, it is difficult to see why this is desired. Such a restriction on the owner is not needed in order to protect the contractor, since the owner can in no event unilaterally escape his personal liability, and since there is also in any event a mechanic's lien available which binds the real estate in the hands of a new owner.

Probably what is really intended by the CEC form, insofar as obligations are concerned, is merely that neither party can escape his liability without the other's consent. Such a provision is unnecessary, however, and to attempt to provide it in the manner used here leads to unnecessary confusion. Since one can hardly believe that a provision in a contract is meaningless, one is always tempted to

assume that it means something; hence, here, one comes to the disagreeable conclusion that this provision in the CEC form is intended to prohibit delegation of performance by the owner.

It is, in fact, difficult to see why the owner should be prohibited either from assigning his rights or delegating the performance of his duties. Neither of these benefits the contractor, and both unnecessarily restrict the owner. Therefore, it is believed that a provision similar to the International form — only a little more explicit — would be preferable to the provision of the CEC form.

Subcontracting

The International form (Sec. 4) says that the contractor shall not sublet the whole of the works. Nor shall he sublet a part of the works without the engineer's prior written consent "which shall not be unreasonably withheld." If he does sublet, under these conditions, the contractor remains liable for the acts, defaults, and neglect of subcontractors.

The CEC form (Sec. 2.3.19) is generally similar as to subcontracting, except that the contractor must submit the names of his proposed subcontractors to the owner for the approval of the engineer at the time specified in the contract documents or when requested by the engineer. There is no express provision that the engineer's approval shall not be withheld unreasonably, however, and it is not obvious whether or not this means that the owner has an absolute right to prevent subcontracting. Apparently, since the decision rests with the engineer rather than the owner, there is no absolute right to prevent subcontracting, but it would be better to specify this in the manner that it is done in the International form.

The CEC form (Sec. 2.3.19), however, contains two useful provisions which are not found in the International form: (1) "The contract documents shall not be con-

buried

The pipe you select

must do the job

under all conditions

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SP-5-60

strued as creating any contractual relation between any subcontractor and the owner," and (2) "The contractor shall bind every subcontractor by the terms of the contract documents."

The first of these provisions presumably is implied in the International form; however, it is better to make it explicit. The principal legal problem involved here is whether a third-party beneficiary can sue in his own name under a contract. It is believed that the answer to this is "no" under the law of some foreign countries and "yes" in others. Under modern American law, the answer to this question is "yes;" therefore, such a provision is useful in preventing the possibility that the owner could be personally liable to a subcontractor under the contract. It should be kept in mind, however, that though there is, in general, no personal liability of the owner to a subcontractor, a mechanic's lien may be just as effective in practice.

The second provision, requiring the contractor to bind subcontractors to the terms of the contract documents, is helpful in making certain that they are under a legal duty to do the work in the proper way. Since there is no contractual relationship between the owner and the subcontractor, the owner cannot maintain an action against the subcontractor, based on the contract. However, he is protected by the liability of the contractor, as well as by the tort liability of the subcontractor if he is guilty of negligence.

Separate Contracts

The CEC form contains a provision (Sec. 2.3.18) saying that the owner may let other contracts in connection with the work of the contractor, and requiring the contractor to integrate his work with that of other such contractors. It is the duty of the contractor to inspect all work of other contractors which would prevent him from performing his own work properly and to notify the engineer of such irregularities. In short, the CEC form expressly acknowledges the possibility of the owner himself being the general contractor on the project.

The International form makes no such express provision. Instead it contains a provision of a different sort (Sec. 59), which permits the owner or the engineer to "nominate" certain subcontractors who shall be regarded as subcontractors employed by the contractor. The contractor is required to employ these subcontractors, provided they will enter into a contract with him obligating themselves to the terms of the general contract and will indemnify the contractor against their failure to perform properly or against any injuries caused by the negligence of the subcontractor or his employees. This seems to indicate that the owner is not to act as his own general contractor. However, no doubt this could be arranged by amending the contract documents. ▲▲

OREGON WASHOUT
A case where floods left steel water line spanning a 50-ft. wide ditch. Line did not fail. Steel pipe continued to carry its own weight and that of water it was transmitting. Southern Pipe Steelcor Products—such as CEMCOTE, mortar lined and coated steel water pipe—are the only products with the hi-beam strength of steel to withstand such tests.

YUMA TERRAIN
A case where rocky terrain and access problems made pipe laying extremely difficult: A select backfill of sand could not be used in ditch. Danger of rupture from settling was obvious. Southern Pipe's own Steelcor product—CEMCOTE, cement mortar lined and coated steel water pipe—was easily handled and laid. Continues to perform.

RIDGE ROUTE TRAFFIC
A case where truck traffic overhead presented serious vibration problems. Steel's inherent resiliency and strength proved the answer. Unlike rigid pipe, steel transmits strain to surrounding soil. Southern Pipe Steelcor Products—a complete line of lined and coated steel water pipe—provide this performance.

TEHACHAPI QUAKE
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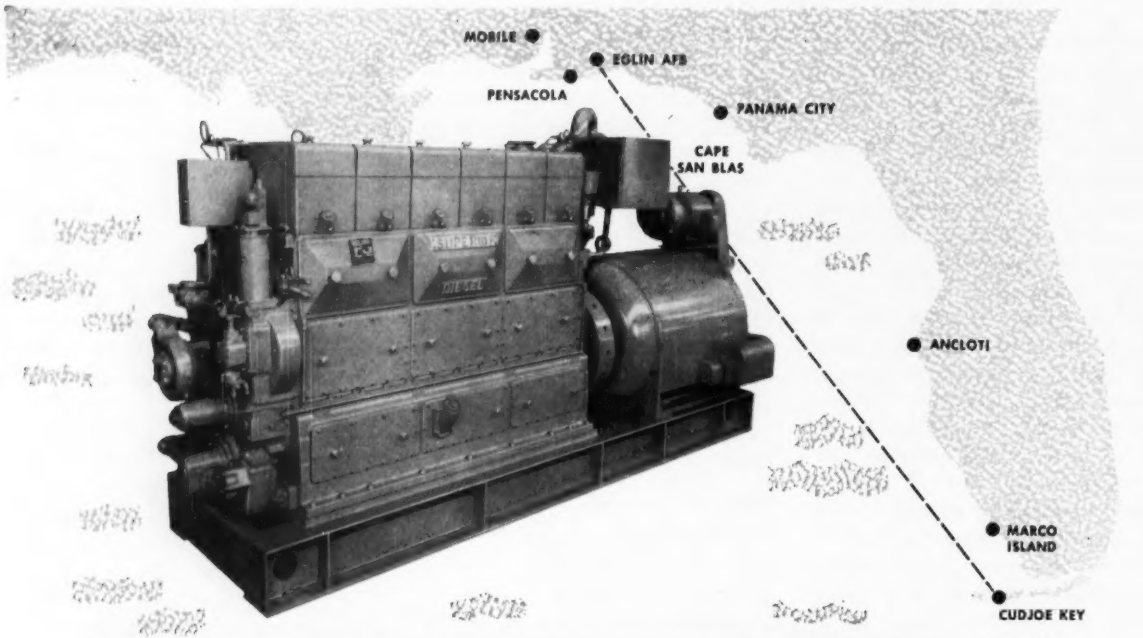
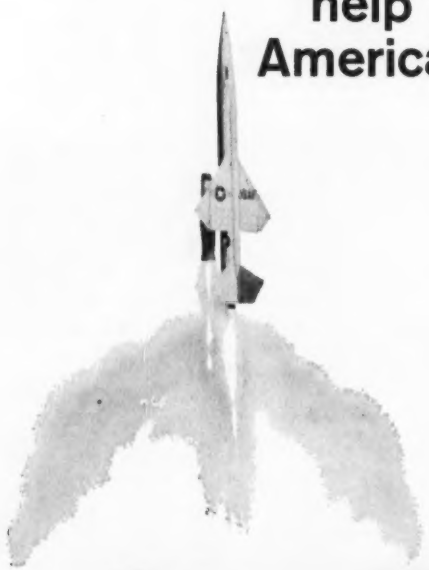


WHITE SUPERIOR ENGINES

help "keep score" at one of America's newest missile ranges



The Eglin Gulf Test Range (EGTR), consisting of five missile tracking stations, extends 450 miles from Eglin AFB, Florida down the west coast to Cudjoe Key, 23 miles east of Key West. At Eglin AFB and at three of the five tracking stations, power is supplied by White Superior Model 40-SX-6 engine-generator sets. Each of the five Superior engines on EGTR develops 361 BHP to produce 250 KW. At Cudjoe Key (shown below), two of the Superiors provide power for range safety equipment, trajectory measuring systems, drone control and telemetering devices, from which data is sent back to Eglin.

America's newest missile range joins an impressive list of Superior-powered U.S. defense installations, which include the "Texas Towers," portions of "DEW" line and the "SAGE" project, Atlas and other launching stations, and other missile tracking ranges. Government acceptance of White Superior engines for these installations is proof that Superior meets all requirements for rugged dependability, trouble-free maintenance and maximum fuel economy. Superior engines, from 215 to 2150 HP or 150 to 1500 KW, can likewise be custom-engineered to meet your exact requirements, including automatic, unattended or remote controlled operation. Write for complete information today!

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• rated for pressures up to 10,000 PSI •

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R-P&C's complete line of bar stock valves includes constructions in 12-14 chromium stainless steel, 18-8 molybdenum stainless steel and bronze. Sizes range from ⅛" to 1" in globe and angle styles with female ends, male and female ends, or male union ends. For extremely severe throttling services, R-P&C bar stocks can be supplied with stellite discs for extra abrasion resistance.

Your R-P&C distributor carries not only a complete line of bar stock valves but also a wide selection of gate, globe, angle and check valves in bronze, iron, and cast and forged steel. You will find the answer to your valve problem in his selection.

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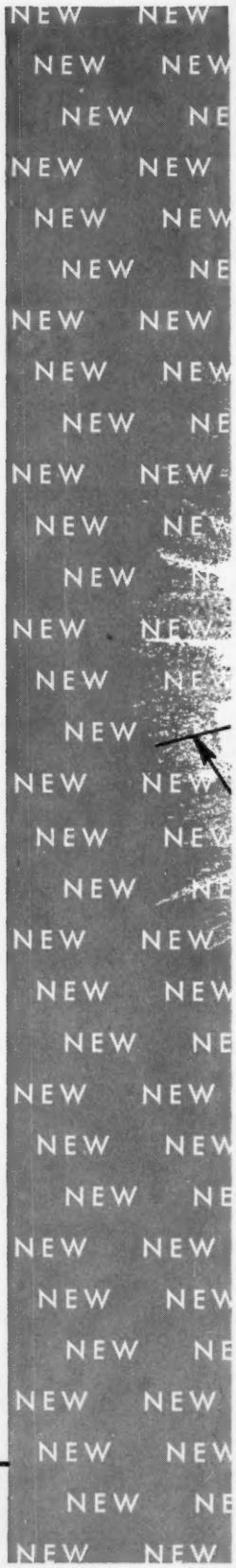

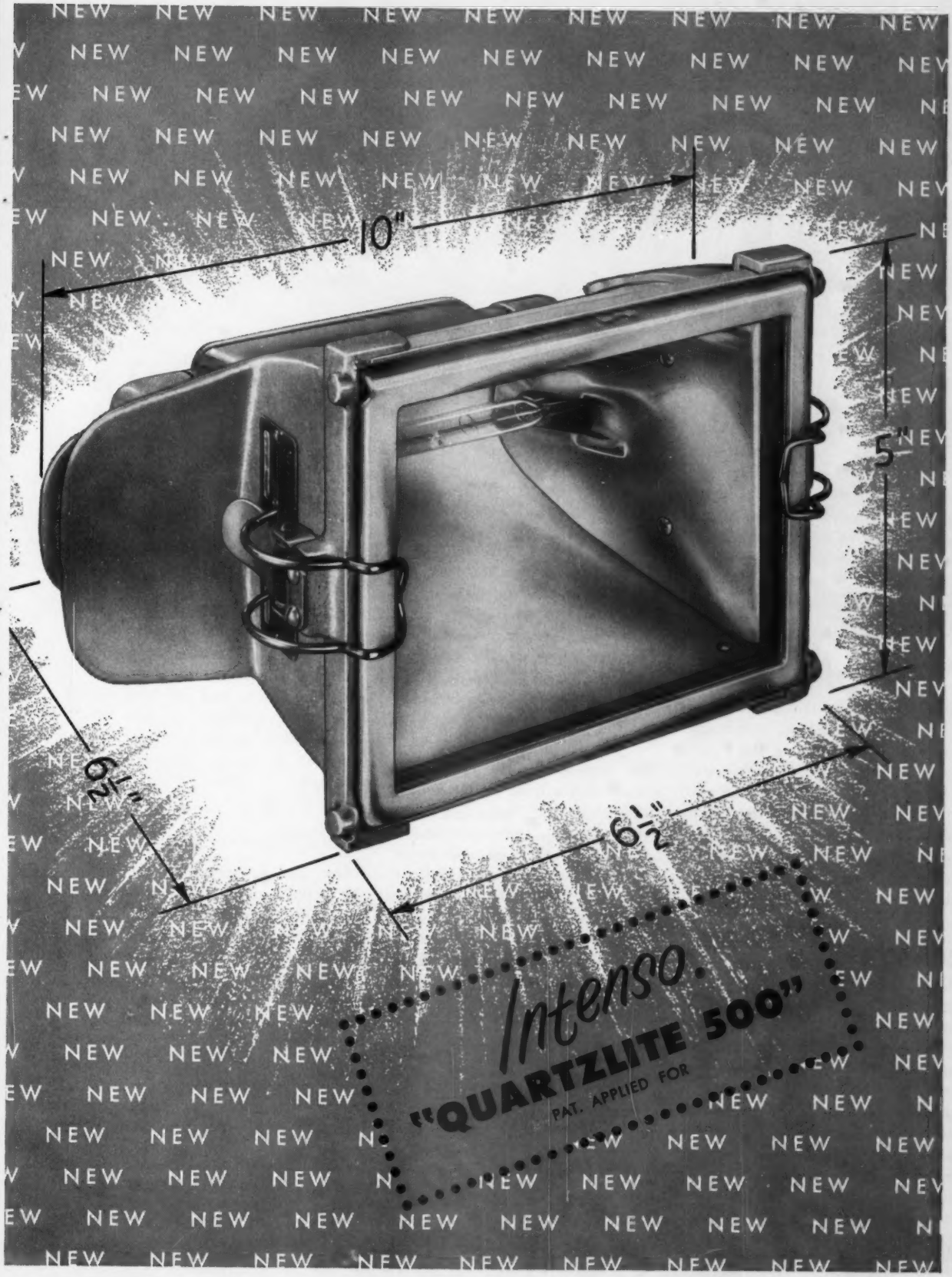
10"
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6½"
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Revitalizing the City

"Only if we recognize that the urban crisis, which is the outcome of deep-seated disease which has progressed for 50 years, cannot be cured by administering aspirin in the form of unrelated small measures, but that an over-all treatment based on a clear understanding of the problems is needed, will we be successful in revitalizing our cities.

"Only if we are willing to accept the automobile for what it is—a servant to mankind and not a deity; only if we are willing to progress in a civilized manner, enlarging our concepts concerning the separation of incompatible uses; only then will we be able to live up to the challenge of the '60s and create superior cities of truly human environmental qualities for the dramatically increasing urban population."—Victor Gruen in *The National Civic Review*, Dec. 1959.

Building Code Problems

"One of the most pressing needs in the [building] code field today is for enabling legislation on the state level which would allow municipalities to use 'adoption by reference.' 'Adoption by reference' means that a community can avoid the often prohibitive expense of publishing in full in newspapers a proposed new code and then holding long, sometimes costly hearings in connection with it, as is usually required. Instead, 'adoption by reference' laws allow the city to adopt an existing model building code without an involved, expensive effort. Changes and amendments in these codes are made under the same local laws governing the enactment of ordinances. Today, about 25 percent of the states have 'adoption by reference' legislation which has made possible up-to-date codes for many communities which formerly had inadequate codes or none at all."—Douglas Whitlock, Board Chairman of the *Structural Clay Products Institute*.

The Importance of Engineering

"The acclaim accorded to Soviet science on the basis of the demonstrated large payload capacity of Soviet rocket engine boosters is another indication of a tendency to attribute to science what is largely the result of technology. Make no mistake about what I am saying, Soviet science is good and is getting better . . . but the launching of Sputnik I did nothing at all to make an informed person believe that Soviet science was any better than he thought it to be the day before the launching. What it did show, and this is important, was the very substantial progress which had been made by Soviet technology in frontier areas.

"The importance of engineering science and engineering are certainly not diminished by the steadily increasing output of science and the speed with which this output can be put to practical use. To the contrary, the richer supply of raw material in the form of basic knowledge is making the job of the engineer ever more demanding, ever more interesting, and ever more important. The Air Force in its increased emphasis on science is not losing sight of the importance of applied research and engineering. The applied research program of the Air Force is roughly 10 times the size of the basic research program, and the basic research program as you are all aware includes the engineering sciences as well as the pure sciences."—Dr. Alexander H. Flax, Chief Scientist, *U. S. Air Force*.

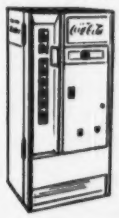
Selling Engineering Knowledge

"The capital goods industries are increasingly in the business of selling highly specialized applications of engineering knowledge. Much remains to be discovered about the techniques and channels of marketing such engineering knowledge. The sales force of the capital goods manufacturer often must assume the role of an 'industrial equipment analyst.' At this point, suffice it to say that the individual member of the sales force is much more likely to be called upon frequently as an 'engineering economist' than has been the case in the past. Similarly, the post-sales problems involved in

Pressure-sensitive, Rub'R-Shim adheres instantly to edges of glass plate—a part of the vendor's long-life "serve yourself" door.

How J-M Dutch Brand Rub 'R-Shim Helped Give

10 Years Maintenance-Free Life to Vendors for Coke†



*A sponge rubber stripping with pressure-sensitive back, Rub'R-Shim graduated to its new application by passing a set of "survival tests". The Cavalier Corporation of Chattanooga, Tenn., was designing its newest vendor for Coke to serve 10 years virtually maintenance free. In the "serve yourself" door, between each of three plates of glass and plexiglas, Rub'R-Shim had to give cushion protection and to seal and insulate air spaces... perform its dual role for 10 years.

One test subjected a cutdown version of the door to a million slams, equivalent of 10 years' rough use. Others tested materials for all-weather durability. A failure in just one test eliminated any material. Rub'R-Shim readily passed all, and became the door's durable insulator/shock-absorber.

As for manufacturing speed and economy, Rub'R-Shim proved as short on application time as it was long on lifetime. Pressure-sensitive, it adhered instantly, held permanently.

See how Cavalier works with its Dutch Brand representative and makes him a part of its problem-solving team. Write for new booklet, "How J-M Dutch Brand Products Helped Cavalier Build a Better Vendor For Coke".

†*Coke—Registered trademark of The Coca-Cola Company.*

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The efficiency of Sparling propellers is the result of extensive laboratory tests which determined the exact pitch and set of the blades. Standard propellers are molded of rugged, resilient plastic which maintains its true shape for the life of the propeller. Normally, propellers are .8 of the inside diameter of the pipe.

Every meter, from 2" to 72" in size, is thoroughly tested before it leaves the Hersey-Sparling plant. Unique volumetric test facilities, the largest in the world devoted exclusively to testing main-line meters, provide simulated field conditions. After the meter index is established by test, the meter is exactly calibrated and geared to register total flows with consistent accuracy guaranteed within 2% of the true flow.

DIRECT TOTALIZATION . . . All Sparling meters provide direct totalization, quickly read at a glance on a 6-digit straight reading totalizer. No computations or tables need be consulted. The totalizer reads in any standard volumetric units—gallons, cubic feet, acre feet, etc. For installations that also require rate of flow, the Sparling Indicator—Totalizer may be used which provides both rate and totalization. For operating auxiliary equipment or remote instrumentation the totalizer is simply replaced with suitable controls.

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PIONEER IN PROPELLER METERS . . . Sparling propeller meters have been used extensively throughout the water works field for nearly half a century. Today, they serve practically every American city or town and are used widely around the world. Sparling equipment includes a complete range of Main-line meters of varied capacities as well as recording instruments and control equipment for complete metering installation.

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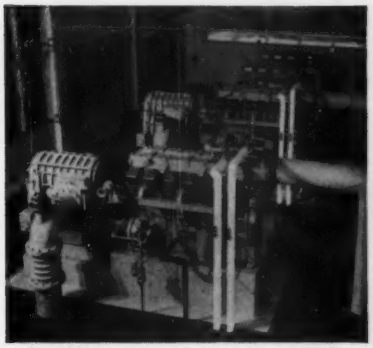
applying engineering knowledge and methods are sometimes as demanding as pre-sale negotiations.

"There is, however, a much more important consideration than this. Current lack of emphasis on engineering knowledge as the end product — or at least as a major component — has led to a failure by capital goods firms to recover engineering costs in two situations:

"1. *Proper evaluation of cost.* In those cases where sizable production runs are not possible, as of course is frequently true of the job-shop operations characteristic of the capital goods industries, unless the market is convinced of the contribution made by the capital goods producer in engineering knowledge and thus takes into consideration engineering costs, the capital goods producer is liable to recover only a part of his total cost. Clearly, to recover total costs it will be necessary to get away from the traditional concept held by capital goods customers who, as a rough guide, measure the value of equipment in terms of so much per pound.

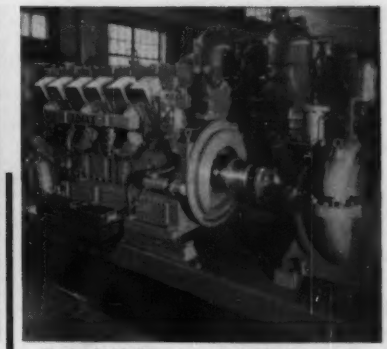
"2. *Preparation of bids.* There is also the necessity of recouping the cost involved in preparing bids. Varying of course with the size of the contract, it is not unusual for a company to spend amounts running into five figures in preparing such bids when obviously only one of the bidders will be able to get any return at all. While this will no doubt sound farfetched in terms of traditional practices in the capital goods industries, it may well be that, as the specifications for equipment grow more and more complex and engineering proposals grow correspondingly if not proportionately costly, such estimates should be paid for much as an architect receives compensation for drawing up plans.

"Beyond these two cases, we repeat, it well behooves the capital goods industries to present an 'industry image' — to use a means of expression common today — which



Four Climax sewage gas engines powering blowers and pumps in a Michigan sewage treatment plant.

Three Climax engines, one Model K-67, and two V-85's driving vertical sewage pumps through right angle gears.



Model V-12 Climax engine in high capacity centrifugal pump service in a city water plant.

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for dependable municipal plant service

Climax engines provide excellent low cost power for sewage and water treatment plants. These rugged, simply designed engines are engineered to give quick acceleration, withstand overloading, and perform longer with less maintenance.

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LP gas • gasoline
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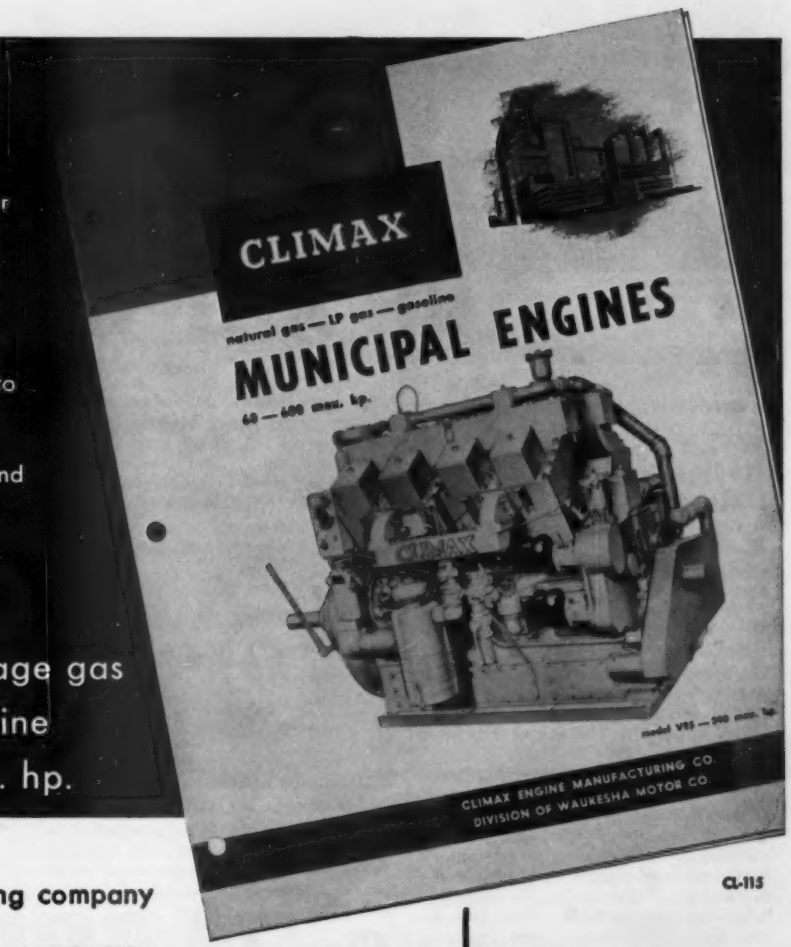

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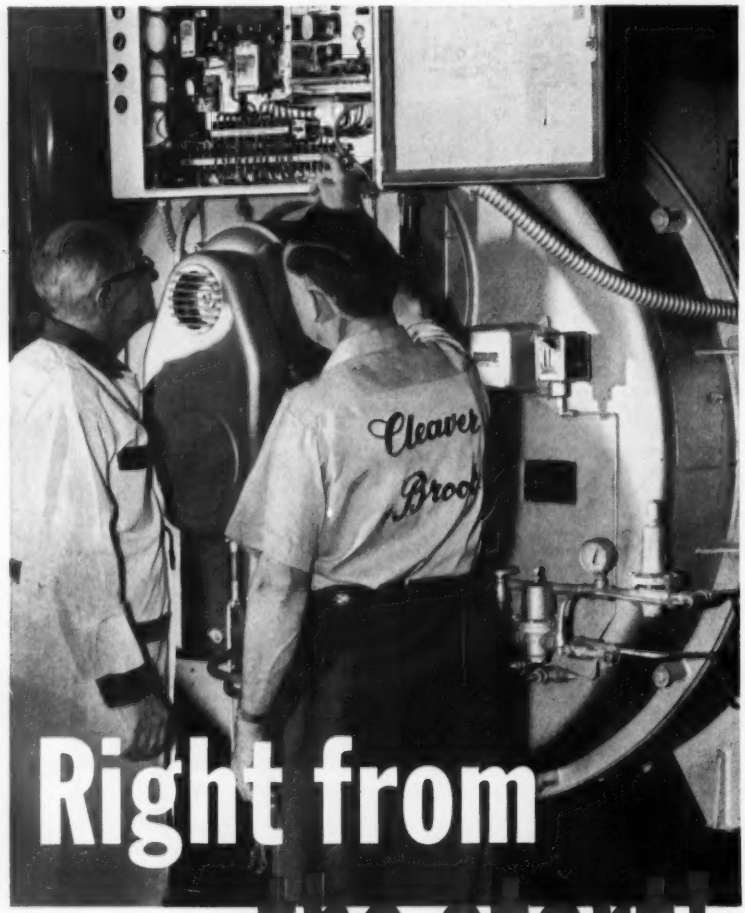

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This comprehensive service means superior performance, satisfied customers. It also means fewer hours on the job for you . . . less cost . . . fewer callbacks. But getting your customer's boiler off to the right start is just the beginning of Cleaver-Brooks complete follow-up responsibility. For example, the industry's finest parts facilities available coast to coast and in Canada back up every boiler purchase . . . safeguard your customer's investment.

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BOILER SCHOOL — A Cleaver-Brooks serviceman also trains the boiler attendant . . . instructs him in boiler care and operation. You're relieved of the time and cost of this important follow-up responsibility.

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ORIGINATOR AND LARGEST PRODUCER OF PACKAGED BOILERS

depicts them as selling highly specialized applications of engineering knowledge." — *Capital Goods Review,* MAPI, April 1960.

States Cut Use of Consultants

"Use of consultants in the highway program continues to decrease. The states report plans to pay only $44 million for consulting services in 1960 in comparison with more than $64 million in 1959, a drop of 31 percent.

"This continues a trend that became obvious two years ago. Total expenditure for consulting services in 1958 was about $75 million (ENR April 23, 1959, p. 102). Except on the Pacific Coast, most states still use consultants to help absorb peak design loads.

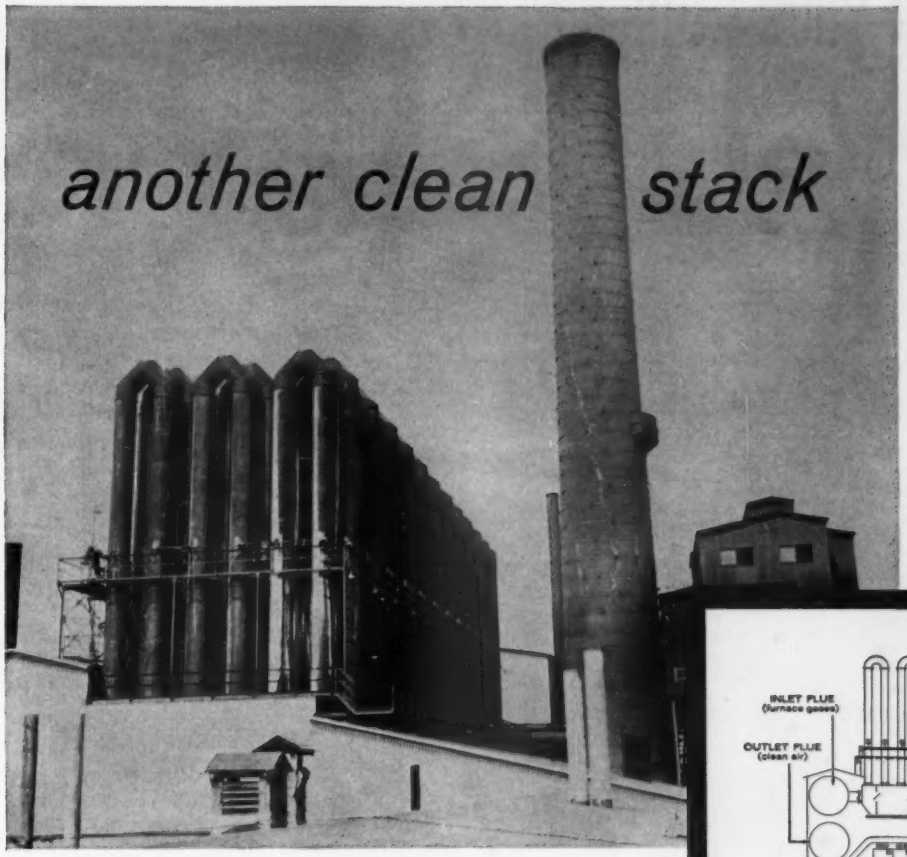
"Outside criticism of consultants in the highway program and strengthened highway departments have apparently been principal factors in the decline.

"Notable exceptions to the trend are Illinois and Pennsylvania. Both states plan to increase their expenditures for consulting services this year." — *Engineering News-Record,* April 21, 1960.

Prestressed Concrete

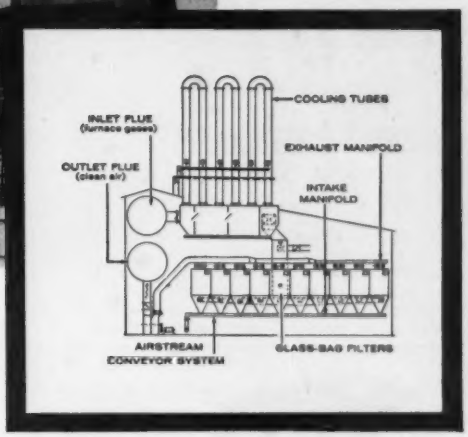
"Prestressed concrete can be used for the structural skelton of buildings of any height. Though it's only a little more than a year ago that the nation's first high-rise prestressed building was completed (14-story Diamond Head Apartment Building in Honolulu), a number are now under construction or on the drawing boards, including one that will be 32 stories. To illustrate how feasible prestress is for tall buildings, Professor Magnel, before his death, had designed a TV tower-office building for the Brussels World Fair made entirely of prestressed concrete and 2000-ft high (nearly twice as tall as the Empire State Building). If he had lived it most likely would have been built.

"Combining of prestressing with thin shell design will increase in



(Left) Cooling tubes atop Glass-Bag Filter housing lower furnace gas temperature from 800°F. to 450°, a full 150° below maximum advisable operating temperature. Clean stack proves that filter removes all visible dust.

(Below) System consists of 12 ten-compartment Glass-Bag Filters. Gases at 800° are blown from electrostatic precipitator to cooling tubes which discharge to filter system, resulting in daily collection of about 35 tons of material.



..."trade mark" of the Dracco Glass-Bag Filter

Freedom from hot, corrosive dust created by metallurgical processes is one of the many benefits of using Glass-Bag Filters. The clean stack shown in the unretouched photograph testifies to the effectiveness of the Dracco system at Hudson Bay Mining & Smelting Co., Ltd., Flin Flon, Manitoba.

Here is what the system does for Hudson Bay:

- **handles 450,000 cfm of mixed reverberatory furnace and converter gases at 450°F.**
- **recovers approximately 35 tons of valuable metal oxide dusts daily.**
- **maintains operating temperature to prevent condensation of exhaust gases and formation of corrosive acid dews.**
- **eliminates air pollution**
- **reduces cooling equipment requirements, and costs, by 50% over conventional methods.**
- **provides low-maintenance operation and gentle bag cleaning with SWING-CLEAN.**

Glass-Bag Filters, the most advanced equipment now available for fighting air polution and hot dust, have been proved-in-performance in the metallurgical, chemical and cement industries. Virtually 100% collection efficiency is maintained at temperatures to 600°F. Maximum bag life is assured by either of two patented cleaning devices: (1) a mechanism for dust removal by sonics and (2) SWING-CLEAN, gentle swaying action.

For full details on how Glass-Bag Filters can help you lick that hot dust problem, write: Dracco Division of Fuller Company, Harvard Avenue and East 116th Street, Cleveland 5, Ohio.

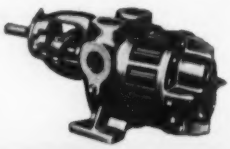
DRACCO *airstream* conveyors
dust control equipment

WHATEVER YOUR REQUIREMENTS FOR ROTARY PUMPS, THERE'S A ROPER TO DO THE JOB

Series T .3 to 55 GPM
Choice of 192 Models

Pump and motor units . . . pump serves as end bell of motor. Require minimum space . . . easily installed . . . no coupling required . . . mount in any position. Each unit approximately same size as NEMA motor of HP required for driving. Open drip proof or totally enclosed motors; single or three phase as required.

ROPER
ROTARY PUMPS



Series F 1 to 300 GPM
Pressures to 300 PSI

Feature helical steel pumping gears, hardened steel shafts, bronze flange-type bearings. 4-port design with 8 optional piping arrangements (4 for CW and 4 for CCW rotation) solves installation problems. With or without built-in relief valve in either mechanical seal or packed box construction.

ROPER
ROTARY PUMPS

Series K ¾ to 50 GPM
Pressures to 150 PSI

Extremely compact in all sizes. Helical pumping gears are hardened steel, with steel shafts and bronze bearings. Sizes 10 through 50 GPM have patented venturi suction and discharge principle for smooth flow and quiet operation. With or without built-in relief valve; packed box or mechanical seal.

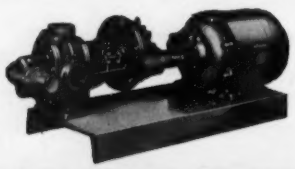
ROPER
ROTARY PUMPS

Series H 5 to 75 GPM
Pressures to 1000 PSI

Designed to operate at direct motor speeds. Used for all types of hydraulic mechanisms where high pressures are required. Hardened steel spur gears for maximum efficiency, and heavy duty roller bearings and bronze wear plates for long life service. Mechanical seal or packed box.

ROPER
ROTARY PUMPS

Series 3600 40 to 300 GPM
Pressures to 100 PSI



Handle thick or thin liquids at slow speeds. Operate in either direction. Hardened iron pumping gears, hardened steel shafts, heavy duty bronze sleeve bearings. Mechanical seal or packed box. Series includes tank truck pumps as well as single motor driven units with gear reduction.

ROPER
ROTARY PUMPS

Send for
"How to Solve Pumping Problems"

Roper Hydraulics, Inc. COMMERCE, GEORGIA
Manufacturers of Standard, Special and Custom Pumps for All Industries

use. Spans up to 1000 feet will be possible.

"It's often said that European countries use more prestress than we ever will because of the low labor costs there. But that factor can be equalized in the United States through extensive mechanization of the manufacture of prestressed concrete products.

"Prestress, of course, is hindered at present in many instances because a local building code makes no provision for it. But there should be a National Building Code established by next year and that will give a tremendous boost to the wide acceptance of prestress.

"Two other items which will contribute to an increasing use of prestress are a greater sophistication of design and new materials.

"For structural design in earthquake areas, prestressed concrete, because of its high strength and flexibility characteristics, is much better than steel.

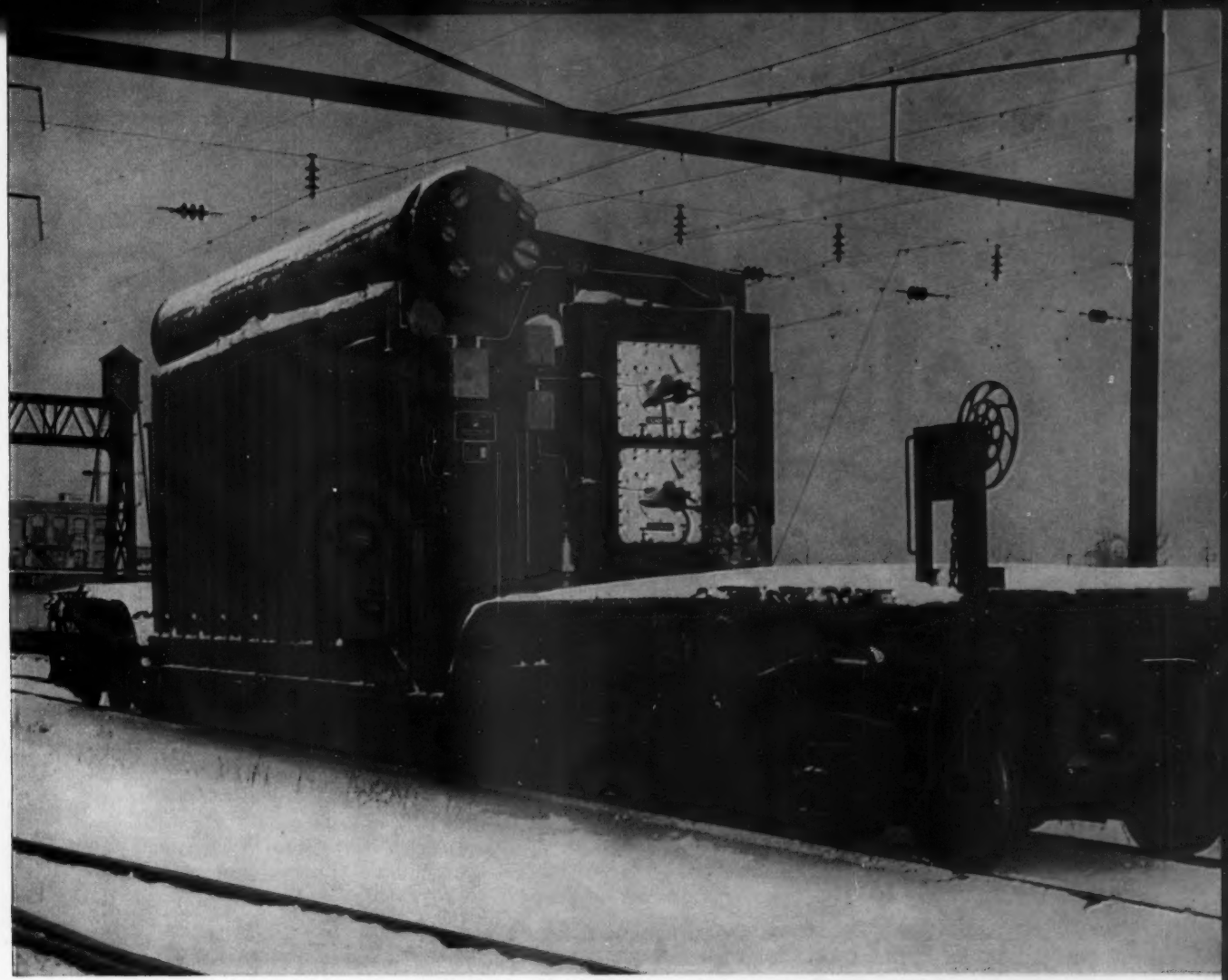
"Prestressed concrete is being considered for the construction of sea water conversion and nuclear explosion tanks. It's probably the only way they can ever be built.

"Right now only one to two percent of new buildings are designed with prestress. Ten years from now I anticipate that figure will be 15 percent." — T. Y. Lin, *This Earth*, March/April 1960.

The Public Works Explosion

"A number of sources, including economists and others whose business it is to chart the future, predict that the total dollar outlay for public works will top $30 billion by 1970—provided the gross national product reaches an expected level of $700 billion. Compared with the $13.6 billion expenditure in fiscal 1957, this prediction forebodes intense activity in engineering, construction, and financing circles.

"Even so, there is a feeling that such expenditures might come too late. The nation's population and industrial production may be grow-



Special purpose application...a standard steam package

This Foster Wheeler packaged steam generator is standard in virtually every respect except for its unusually high design pressure. The AGX-series unit shown here will deliver over 65,000 lb of steam per hr to test high pressure steam turbines at DeLaval Steam Turbine Company, Trenton, N. J. The Foster Wheeler AGX-series packaged units are designed to operate at pressures from 901 to 1,350 psi.

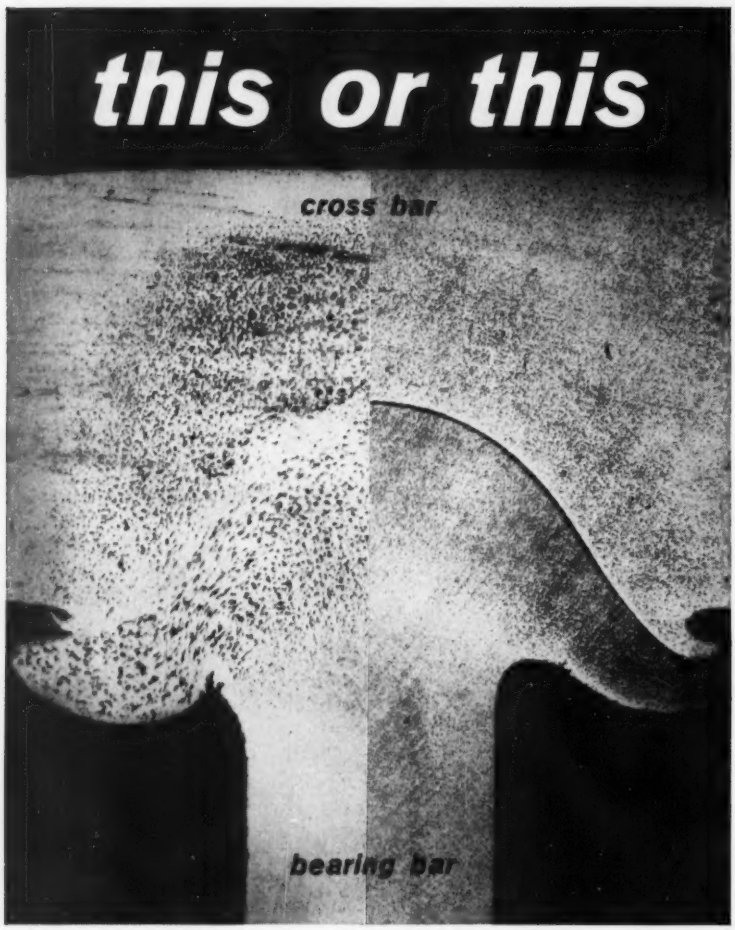
Don't let out-of-the-ordinary steam requirements keep you from considering the economy and convenience of a packaged steam generator installation. The proven basic design of standard Foster Wheeler steam generators allows you wide latitude for adapting to special needs.

Look at the features you have to work with. High steam purity, generous furnace volume, highly efficient convection tube bank, liberal drum size, removable drum internals, to name only a few. All necessary standard equipment is included.

There's no better or more complete packaged steam generator design available today at a comparable cost. Write for FW bulletin PG-58-2 *before* you write specifications for *any* steam generator from 13,000 to 100,000 lb/hr capacity at pressures from 270 to 1,350 psi. Foster Wheeler Corporation, 666 Fifth Ave., New York 19, N. Y.

FOSTER FW WHEELER

NEW YORK LONDON PARIS ST. CATHARINES, ONT.



This is Dravo Tru-Weld Grating. In this cross section of a cross bar-bearing bar weld, the metal has fused together. There are no gaps to admit moisture or weaken the joint. It cannot come apart.

Here fusion of metals is incomplete. There is a noticeable gap between bearing bar and cross bar, an open invitation to internal corrosion which can weaken the joint and add to maintenance costs.

which weld for your grating?

Tru-Weld grating is stronger because it is *made* that way. Its added strength comes from a manufacturing process that completely fuses the metal at cross bar-bearing bar joints and holds the bars to exact spacing. The result is grating that stands up under excessive vibration, heavy traffic or in areas where corrosive fumes and moisture are a problem. And Dravo Tru-Weld grating *costs no more.*

Complete estimating, layout and fabricating services are available. Immediate delivery from stocks maintained at nearby Joseph T. Ryerson Service Centers will help you meet exacting construction schedules.

For more information on this new, stronger grating, call the Dravo representative in your area, or write DRAVO CORPORATION, PITTSBURGH 25, PA.

DRAVO
CORPORATION

ing too fast for normal programs to stay abreast, let alone catch up. These suspicions seem well-founded. Highways are jammed now, and the automotive industry confidently forecasts still higher production rates. Open dumps are inadequate, but only a few communities have studied ways and means of overcoming this deficiency. Hospitals are full, and the number of people who need them most grows proportionately larger each year. Schools are overcrowded, and the birth rate hits higher levels each year. Parks and recreational facilities are added but not sufficiently fast to combat juvenile delinquency which has mushroomed into a national problem.

"Moreover, many existing structures, roads, and systems are wearing out or becoming too small for the job they originally were designed to do. The period of major construction for public works was during the depression – well over 20 years ago. Repairs and expansion programs now are needed just to keep existing facilities functioning with some semblance of efficiency." – Fay, Spofford & Thorndike, Inc. *Bulletin,* Vol. 5, No. 1.

The Need for Mass Transit

"No major metropolitan area in the world can exist indefinitely without a sound permanent system of mass transportation . . . There are factors of tremendous inertia, inherent resistance to change, and financing problems to be overcome. The successful growth of our Los Angeles community is dependent . . . on the ability of its citizens and leaders to overcome such resistance and implement the transit system . . ." – Irvan F. Mendenhall to the *Los Angeles Metropolitan Transit Authority.*

Dear Mr. Congressman

"An article in the *Chicago Daily News,* March 21st, states that investigators of a special congressional investigating committee are probing the activities of several

THE BYRNOVER INDUSTRIAL DOOR

It's trackless
It's fast-operating

...it offers substantial cost advantages

Here's a brand new concept in industrial door design . . . and tests prove that it offers extraordinary dependability in its trouble-free operation.

At the Byrne factory, one of these doors has been opened and closed more than 40,000 times, at a speed of 120 feet per minute, without a sign of failure of any part. This, theoretically, represents the average use of an industrial door over a period of ten years.

In addition to speed of operation, the Byrnover Door offers many other advantages. It requires minimum head and jamb clearance. Because there are no interior horizontal tracks, it allows a clear unobstructed work area to within 18 inches of the door opening. It is equipped with positive safety features . . . is simple to install . . . and, of major importance, is lower in cost than comparable doors.

A new brochure describes the Byrnover Door in complete detail including all general specifications. Write for your copy . . . today.

BYRNE doors, inc.

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101 Park Ave., New York 17, N.Y. • Cafritz Bldg., Washington, D.C.
Byrne Doors of Canada Limited, 4 Collier St., Toronto 5, Ont.

MEMBER OF THE HANGAR AND INDUSTRIAL DOOR TECHNICAL COUNCIL

Back in the era of bustles and high-button shoes, certain classes of 'joints" were viewed by some as objects of scorn or derision. They even took steps to eliminate this condition of the times through the customary process of law.

Now, decades later, a completely new type of "joint" has appeared on the scene . . . no swinging doors on this one, either. It's KAUL Presto-SEAL, the ***vitrified clay pipe that joints like magic.*** And—it's gaining in popularity and certified approval by public works departments, engineers and contractors everywhere . . . by men who recognize the importance of fast pipe assembly, tight, permanent joints, assured resistance to root penetration and absolute shear load resistance. KAUL Presto-SEAL pipe features a new factory-molded-polyester compression joint with a high-quality rubber gasket permanently imbedded in the socket **where it belongs.** This revolutionary development has made Presto-SEAL a standard of quality on installations with rigid infiltration-exfiltration requirements. It's your absolute assurance of leak-proof, root-proof and corrosive-resistant lines that last forever.

Manufactured to A.S.T.M. Specifications, Presto-SEAL is available in a complete range of pipe sizes from 4" to 36" diameter, with matching fittings. ***That's right, one joint for all sizes of pipe!***

So, don't wait for an Act of Congress to make known your wants, like the folks of yesteryear did. Write today for facts that prove Presto-SEAL pipe by KAUL is best by test for all industrial waste and domestic sewer jobs.

*T.M. Reg.

KAUL clay company

TORONTO, OHIO * U. S. A.

"Exclusive manufacturer of Presto-SEAL pipe that joints like magic"

states seeking evidence of collusion between state highway officials and contractors in connection with the interstate highway program. To seek out and punish wrongdoers is important.

"However, the subcommittee's stated 'interest' in the use of consulting engineering firms for the design of a portion of these highways, together with the tone of several reports released by the General Accounting Office, leave the impression that free enterprise, especially in the profession of engineering, is suspect, without even the formality of examination.

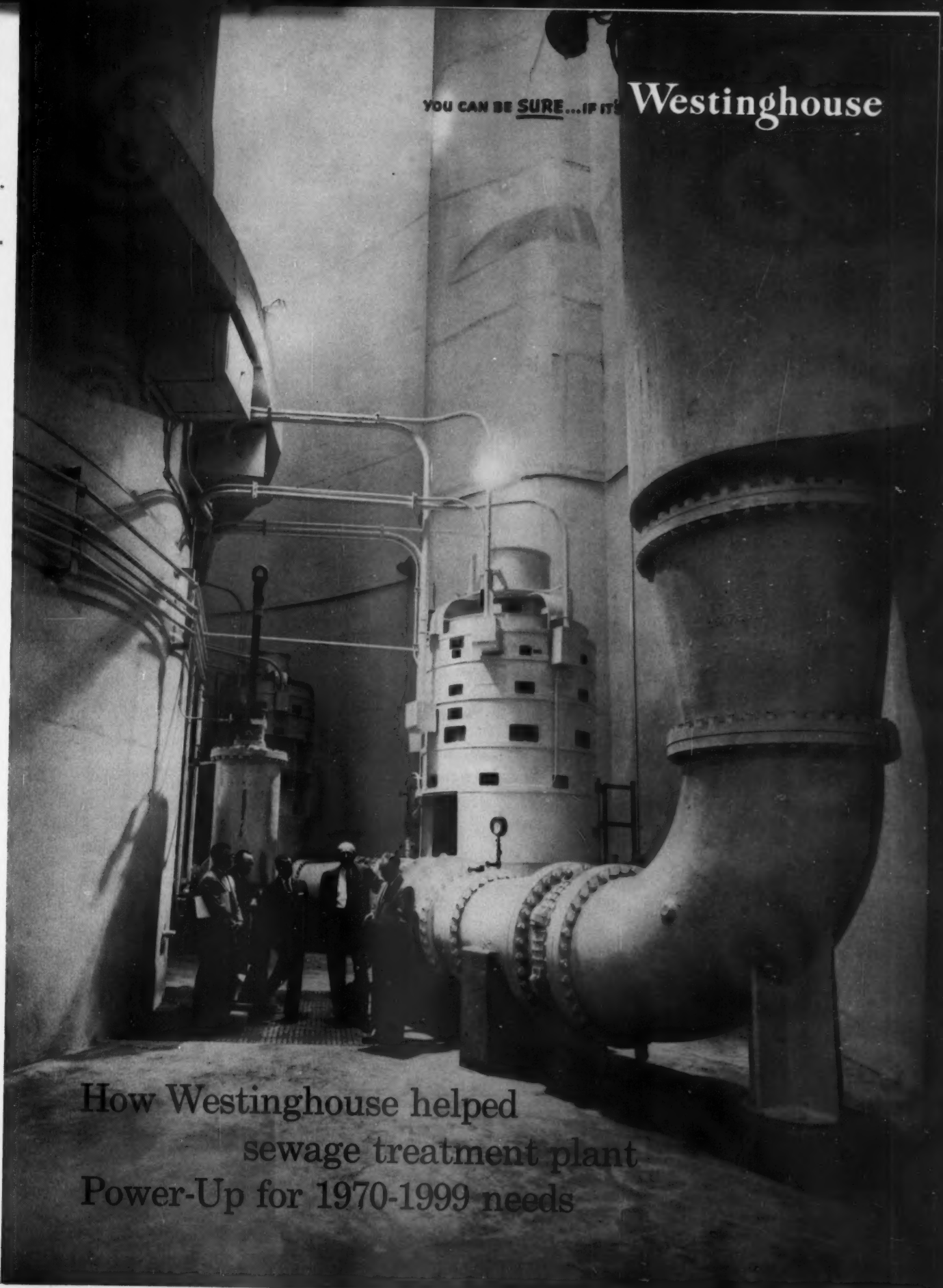
"The administration is doing a disservice to one of our most important professions, and one familiar with what's taking place can only come to the conclusion that the administration's policy is to do away with private enterprise in this field and force the highway engineer into employment with the Bureau of Public Roads or one or another of the political subdivisions.

"I'm sure that I speak for all consultants in the highway field when I ask that an unbiased study be made at random nationally, and a true comparison of design costs for highways be made; that is, the cost in fees paid to consultants as opposed to the realistic costs of design for new construction, using the engineering personnel of the various highway departments.

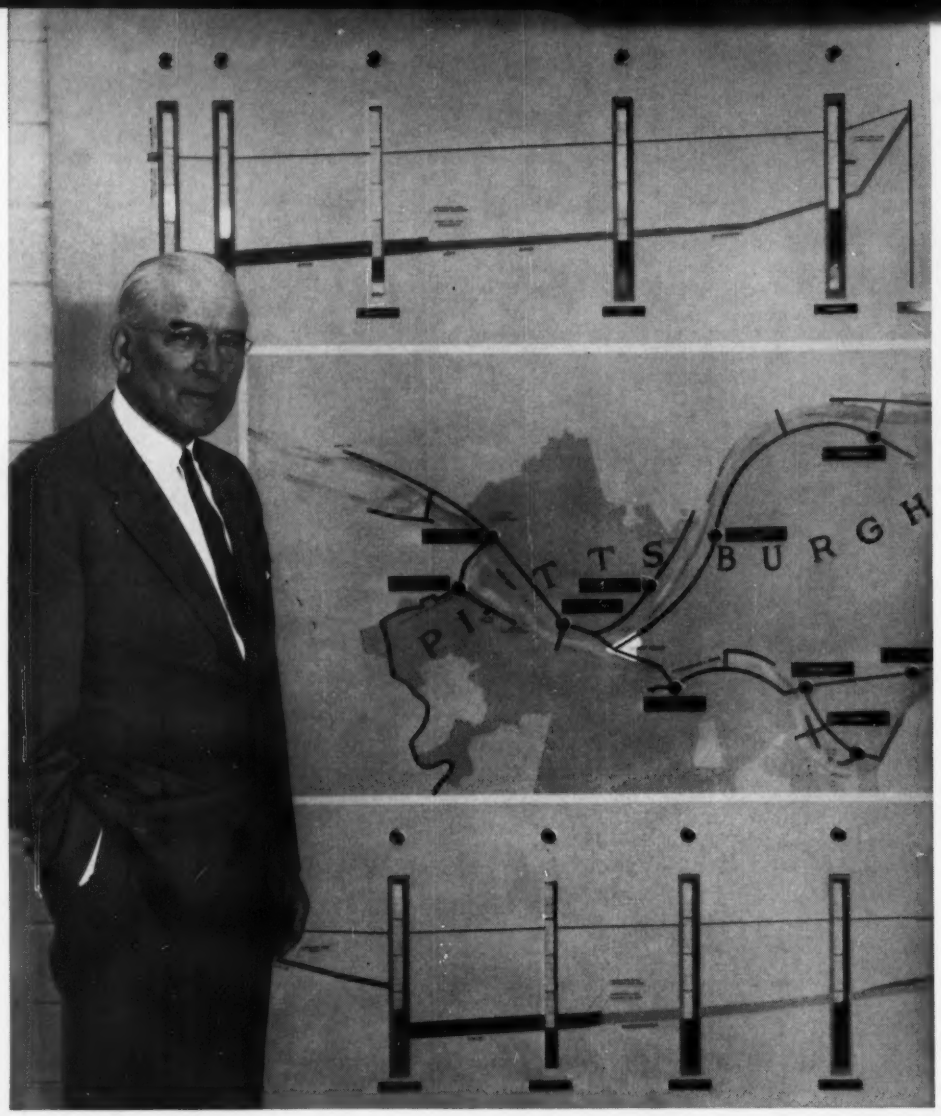
"The only fair basis of such a comparison is a percentage of construction costs.

"We have a pretty good idea of the results of such a comparison, but to attempt to state exact figures would be just as silly and just as much without foundation as the remarks published by the GAO.

"I personally request your reactions to these remarks; also, I would appreciate having your view of the administration's policy in fostering or rejecting free enterprise in this important endeavor." — a letter from Jack Campbell, *Campbell & Maccabee,* to U. S. Senator Everett M. Dirksen. ▲▲


YOU CAN BE SURE...IF IT'S Westinghouse
How Westinghouse helped
sewage treatment plant
Power-Up for 1970-1999 needs

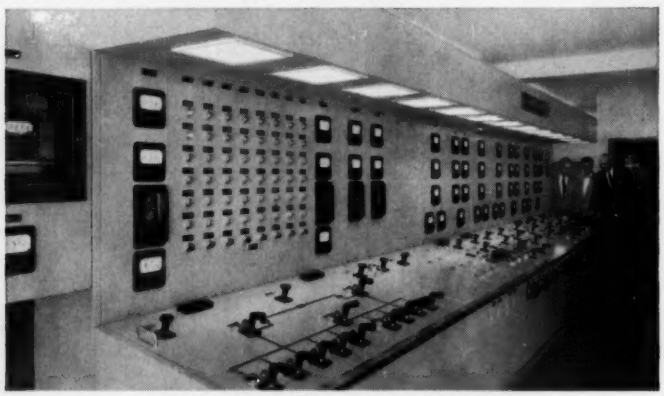
Front Cover: View in dry well of main sewage pump driven by Westinghouse 450/1250-hp 2-speed vertical synchronous motor in foreground. Constant-speed 800-hp motor in background drives its pump through a variable-speed magnetic coupling. Dry well is illuminated with Westinghouse VEK-16 floodlighting. Discussing installation are: A. B. Janaszek, Westinghouse Sales Engineer; M. B. Trimble, Westinghouse Construction Engineer; N. J. Grady, Devlin & Ernst, Electrical Contractors; J. F. Laboon, Executive Director and Chief Engineer, Allegheny County Sanitary Authority; A. A. Thomas, Engineer for Operations, Metcalf & Eddy, Consulting Engineers.



J. F. Laboon, Executive Director and Chief Engineer of Allegheny County Sanitary Authority, shown beside system flow panel of the $100 million trunk sewer and treatment plant project which serves 70 separate communities. The mimic diagram depicts flow conditions throughout a 69-mile network of tunneled interception sewers. The plant and its operation incorporate the process of concentrating undigested sludge for incineration.

J-94134-2

Examining sewage treatment system plans in the director's office are N. J. Grady, M. B. Trimble, A. B. Janaszek, J. F. Laboon and A. A. Thomas.



Over-all view of the main duplex control board installed in the sewage pump station. This board centralizes control of the incoming power feeders, indicates alarm conditions for each main sewage pump and also provides centralized control of pump motor speeds and performance. Shown at far end of control board are A. A. Thomas, A. B. Janaszek, J. F. Laboon and N. J. Grady.

Pittsburgh Sewage Treatment Plant builds for population growth of next 40 years

Planning by the Allegheny County Sanitary Authority went far beyond today's needs to anticipate the requirements of 1970 and beyond, to the year 2000. The new Pittsburgh Sewage Treatment Plant which serves the combined populations of 70 separate communities is now capable of handling the increased demands of 1970 populations. In addition, those structures and conduits which are not readily expandable are designed for the ultimate flow demands of the year 2000.

The Westinghouse electrical distribution system specified was planned with the same anticipation of future needs. Each component was selected to perform as part of the completely coordinated system. The entire system is capable of ready expansion to meet the increased power requirements of the future operating load of the plant.

Westinghouse electrical equipment supplied to Power-Up this 150-mgd sewage treatment project (max. rate, 300 mgd) includes:

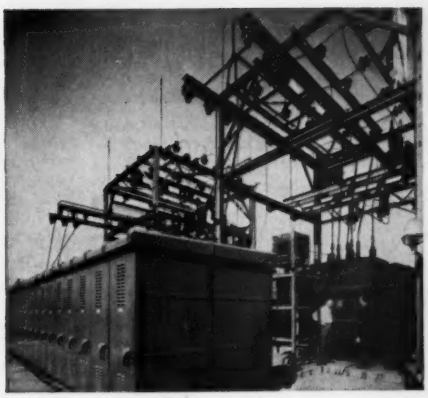
- 10,000-kva outdoor substation.
- Main pump control board.
- Three main sewage pump motors (vertical, synchronous), 1250/450 hp, two speed, two frame.
- Two main sewage pump motors (vertical, synchronous), 800 hp, 400 rpm.
- Two major assemblies of high-voltage fused starters and metal-clad switchgear.
- Five indoor dry-type power centers (150 to 3000 kva).
- Seventeen motor control centers as well as panelboards, dry-type transformers and standard controls.
- Westinghouse Life-Line® motors and gear drives which are utilized on pump, conveyor and auxiliary drives.

(contd.)

YOU CAN BE **SURE**... IF IT'S

Westinghouse

J-94134-3



General view of outdoor substation at Pittsburgh Sewage Treatment Plant. Shown is Westinghouse metal-clad switchgear used for incoming line, bus-tie and distribution service, as well as one of the 5000-kva oil-insulated power transformers at the station. Also shown are Westinghouse disconnect switches, grounding resistors and outdoor substation structure. M. G. Grasha, Plant Electrical Engineer, discusses installation with M. B. Trimble.

A. A. Thomas, J. F. Laboon, N. J. Grady and A. B. Janaszek shown in main control room with line-up of Westinghouse Ampgard* fuse starters for control of the main sewage pumping motors. Metal-clad switchgear in the middle of the assembly provides incoming line protection for each starter group.

*Trade-Mark

M. B. Trimble and M. G. Grasha inspect electrical equipment in administration building basement. At right is rear of motor control center close-coupled to 150-kva dry-type power center transformer; at left is a 75-kva Type DT-3 dry-type transformer feeding a Westinghouse NLAB lighting panelboard.

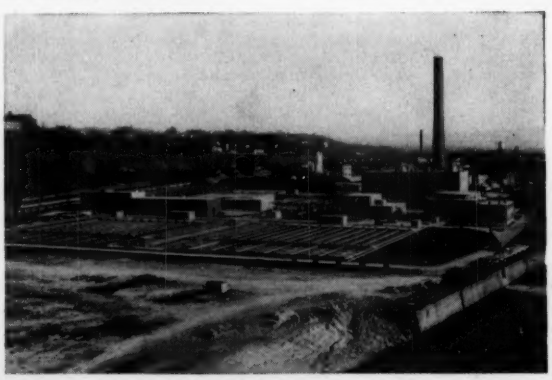
General view of main pump station looking from the bottom of the dry well up to the main operating floor level 120 feet above.

Sewage plant builds for next 40 years (contd.)

Powering-Up electrically for future growth provides many initial and future savings in public works projects. For information as to what such savings can mean to you, call the Westinghouse electrical construction engineer nearest you, or write: Westinghouse Electric Corporation, Box 868, Pittsburgh 30, Pennsylvania. J-94134-4

OWNER: Allegheny County Sanitary Authority
CONSULTING ENGINEERS: Metcalf & Eddy, Boston, Mass.
CONSULTING ARCHITECTS: Celli-Flynn, McKeesport, Pa.
ELECTRICAL CONTRACTORS: Devlin & Ernst, Pittsburgh, Pa.

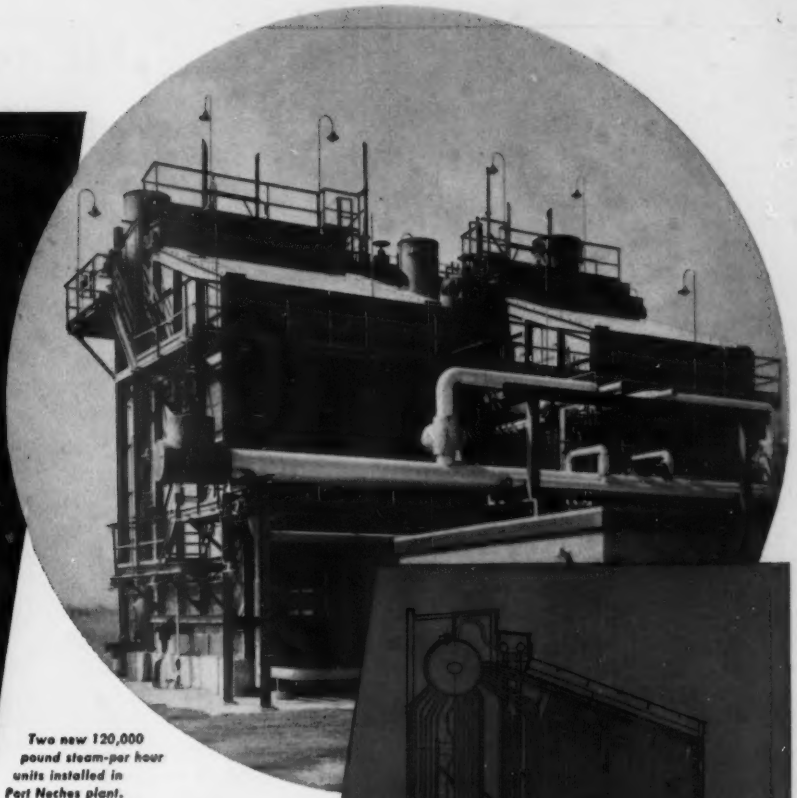
Over-all view of Pittsburgh Sewage Treatment Plant. In foreground are the main sedimentation tanks and the effluent channel which discharges into the Ohio River. Circular building at far right is main pump station, behind which is the incinerator building with 300-ft-high stack, a landmark of the installation.



YOU CAN BE SURE...IF IT'S Westinghouse

TUNE IN WESTINGHOUSE-CBS TV-RADIO COVERAGE, PRESIDENTIAL CONVENTIONS, JULY 10-29

Steam for Jefferson Chemical by Vogt



Two new 120,000 pound steam-per hour units installed in Port Neches plant.

The needed additional power and process steam capacity for Jefferson Chemical's expanded Port Neches plant is furnished by the two Vogt boilers pictured here, each with a capacity of 120,000 pounds per hour. The boilers are designed for 675 lbs. pressure to operate at 625 lbs. pressure and 769°F. total temperature. The furnaces are equipped with gas burners and have water cooled front and side walls.

Bulletins describing Vogt boiler installations in a variety of industrial plants for power, processing and heating are available on request.

Installation by C. F. Braun and Co., Engineers.

For Custom Installation Bulletin VF-VS-2 • Package Unit Bulletin PSG-3, address Dept. 24A-BCE.

HENRY VOGT MACHINE CO., LOUISVILLE, KENTUCKY

SALES OFFICES: New York, Chicago, Cleveland, Dallas, Camden, N.J., St. Louis, Charleston, W.Va., Cincinnati

Custom Built By... Vogt

STEAM GENERATORS

Heard Around Headquarters

MARJORIE ODEN,
Eastern Editor

A STUDY of the NSPE survey report, *The Role of the Consulting Engineer in Federal Public Works Projects*, indicates that consulting engineers are getting short shrift on much government work. It appears that there are as many fees falling below recommended minimums as there are above, using either the ARBA or NSPE published fee curves. Only a politician with an eye to election year votes could pretend to find any evidence of excessive payments to consultants. But one begins to wonder if the investigations might not be reversed and aimed more at unethical fee cutting to get government work. Some fees are so ludicrously low they imply desperation.

Corporate Practice for Engineers

Corporate practice for consulting engineer firms was favored 51 to 15 in a recent survey by the Illinois Association of Consulting Engineers. IACE member firms voted almost 5 to 1 in favor of corporate practice, while nonmembers voted about 2 to 1 in favor. However, there is a considerable divergence of opinion as to the exact nature of the legal restrictions that should be placed on corporate practice if Illinois were to change the law to permit it.

Estimates of the proper percentage of stock ownership to be retained by professional engineers ranged from 51 to 100 percent, with the median falling at 85. The majority was in favor of limiting the right to seal plans to individuals only; restricting firm management to professional engineers; and limiting corporate officers to professional engineers. Less than half of the respondents indicated that they would switch to corporate practice if enabling legislation was passed by the state government. Currently, about 25 percent of the respondents are practicing under corporate structures established prior to the passage of the Professional Engineers Act or under the Structural Engineers Act.

Comments offered by those participating in the survey indicated only mild enthusiasm for corporate practice, with a number of firms indicating that they were unsure of its value. In the opposition camp, there were some strong negative statements, particularly with regard to the effect of corporate practice on the professional status of the consulting engineer.

Michigan Association Elects

John W. Kushing, Lansing public utility consultant, was elected president of the Consulting Engineers Association of Michigan at its annual meeting in April. F. Spencer Weber, partner in Hazelet & Erdal, was elected vice president; Anton Krapek, partner in E. Roger Hewitt Associates, Inc., secretary; and George T. Crothers, partner in Stapert, Pratt, Bulthuis, Sprau & Crothers, Inc., treasurer. Directors are Karol Piotrowski, Robert H. Gove, and Arthur Gillespie.

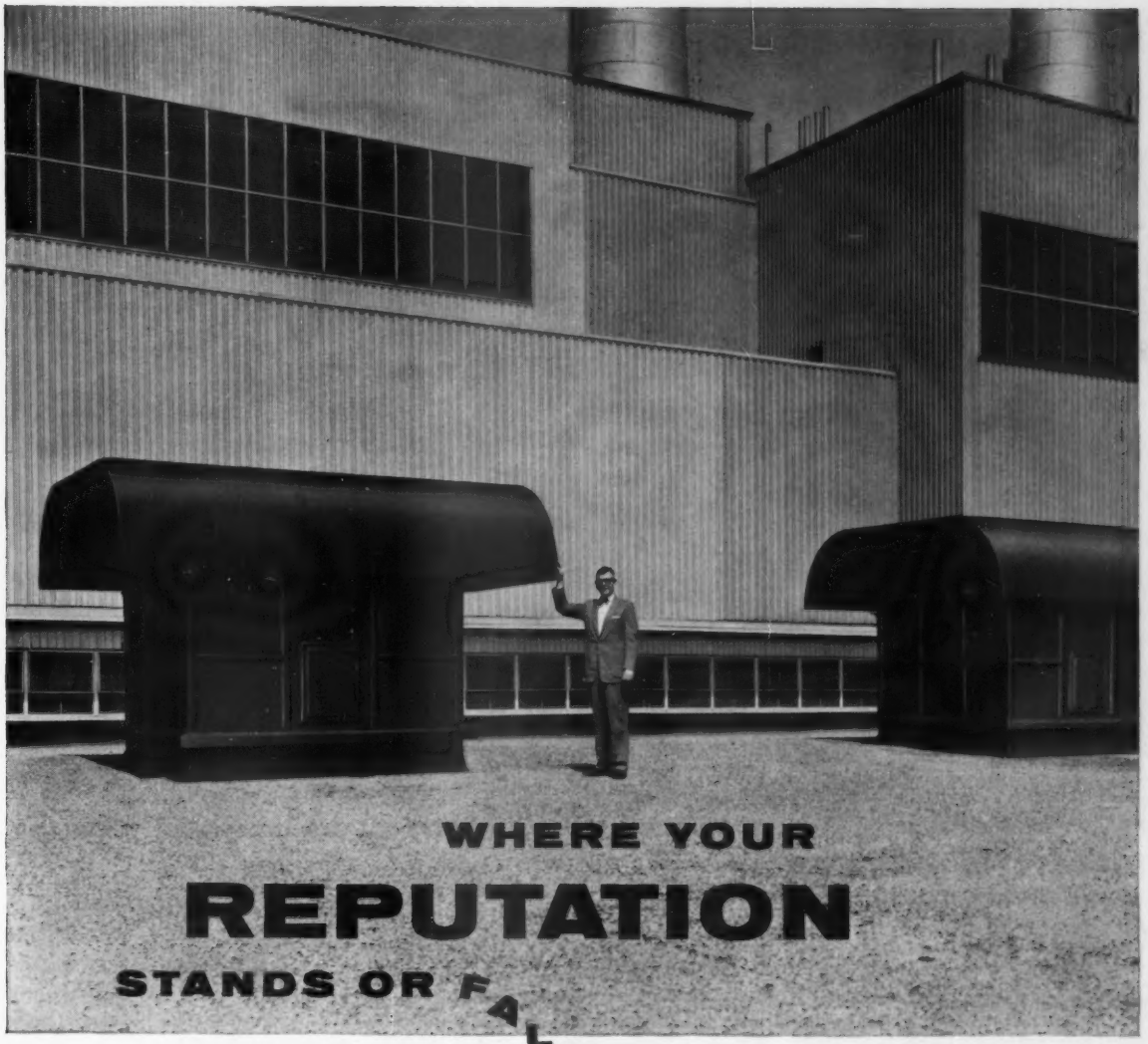
This Consulting Engineers Association of Michigan has the doubtful distinction of being the only state association of consulting engineers that is a member of Consulting Engineers Council and also is a Functional Section of a State Society of Professional Engineers. It is likely to remain the only one, too. Most consulting engineers in Michigan, including a lot of members and ex-members, feel that the ideal of amalgamation is altruistically excellent but practically a handicap to all. As one member put it, "Why shouldn't we have an Oedipus complex; we *did* marry mother!"

Publish Name of Expelled Member

For the first time, the American Society of Civil Engineers has sanctioned the publication of the name of a member expelled for violating the Code of Ethics. In line with a new policy, the name was published in near agate type in a report of board proceedings, in the April issue of *Civil Engineering*.

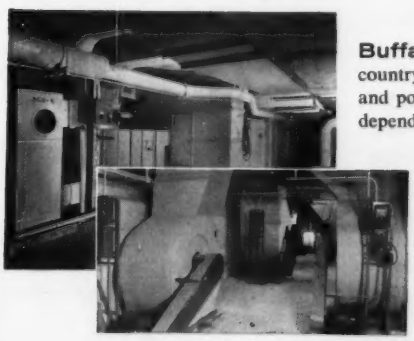
The unlucky first is Edward A. Elevatorski, of Scottsdale, Arizona. "Mr. Elevatorski was found to have made false statements regarding his educational status in his application for membership in the Society," according to the write-up in *Civil Engineering*.

Elevatorski has taught at the University of Arizona and is the



. . . that's **on the job!** Since no installation can be better than its equipment, it pays to be positive about the make and the maker!

In the case of your air handling jobs, you **can** be positive about performance. Just specify Buffalo Air Handling Equipment and enjoy no-callback performance. You save service calls and the customer is happy. Your reputation grows!



Buffalo Equipment—An 83-year Reputation on the Job. In the country's biggest industrial and commercial installations . . . in ocean liners, stores and power plants . . . Buffalo Fans, Pumps and Air Handling Units are performing dependably and efficiently. Many Buffalo Fans and Air Washers are still going strong after sixty or more years on the job! Performance like this reflects well on the firm doing the installing. On your next job, don't make it "or equal" — make it 'Buffalo' and rest assured of satisfaction.

BUFFALO FORGE COMPANY
Buffalo, New York

"Buffalo"

Buffalo air handling equipment to move, heat, cool, dehumidify and clean air and other gases.

Buffalo Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

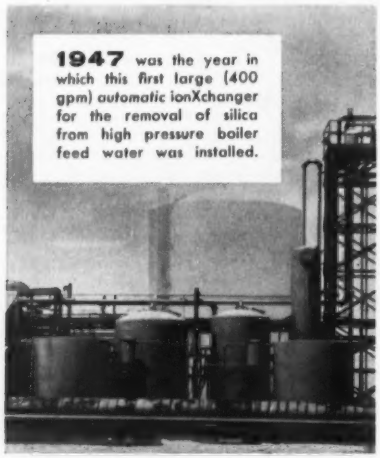
Buffalo Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

PATHWAYS OF A PIONEER

ILLCO-WAY DESIGNERS AND BUILDERS

MODERN EQUIPMENT FOR ionXchange


1947 was the year in which this first large (400 gpm) automatic ionXchanger for the removal of silica from high pressure boiler feed water was installed.

Blazing the Way for De-I Developments

Again we bring you an example of how IWT has always been in the forefront of the development of practical and successful ion-exchange equipment. The big boiler-water de-ionizer shown above is now more than 12 years old, is still in operation, and has been joined by two more IWT units of similar size in this sprawling midwestern chemical plant. Many other early users of ILLCO-WAY ionXchange have since *added to* and *modernized* their installations as new developments became available.

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author of a textbook. At last report, he was working for a consulting engineering firm.

Prior to his ASCE troubles, Elevatorski was a member of the American Society of Mechanical Engineers. He resigned from ASME several months ago.

CEAO Installs Officers

New officers of the Consulting Engineers Association of Oregon were installed at the recent meeting of the Consulting Engineers Council, in Gearhart, Oregon. The new officers are: president, Harry Czyzewski; vice president, Lloyd K. Clark; secretary, Irving E. Olsen; treasurer, Thomas C. Jamieson; new directors, Ray Chewning and James Howland; and holdover directors, Robert Welty and Marvin Runyan. They were installed by C. C. Pate, past president of CEC.

Choice of Two Policies

Engineers Joint Council has had two policies submitted on the use of consulting engineers on public projects. Some time ago, the American Society of Civil Engineers' policy was submitted to EJC with a request for action. Consulting Engineers Council also has sent its "Statement of CEC Policy Regarding Private or Public Engineering" for possible EJC endorsement. The first question is "will EJC adopt *any* policy on private or public engineering." This decision is not likely to be forthcoming soon.

"Vanishing Americans"

Joseph Amann, president of the Engineers and Scientists of America, told CONSULTING ENGINEER in 1957 that ESA would love to unionize employees of consulting engineers, but a limited budget at that time prevented any such aggressive action.

Recently CONSULTING ENGINEER made another check with the union president to see if consulting engineers' employees currently are in the union plan — of ESA or of any other union. The answer — "We consider consulting engineers as vanishing Americans, and therefore plan to make no effort to unionize their people," Amann stated.

At the time of the 1957 interview, ESA was in the midst of troubles. This group had — and still has — only engineer members. This caused a disagreement and the subsequent formation of the Engineers and Scientists Guild. The announced ESG aim was the combination of engineers and technicians into a single union because of their "common interests." But ESG learned that it is easier to form a union than to run one, and ESG is no more.

Among the first to leave ESA when the argument over "pure" engineer membership began was the powerful Engineers and Architects Association, a West Coast group with about 15,000 members at the time. This organization had refused to pay a $1 per member special assessment for an organizational fund, and was expelled as a result.

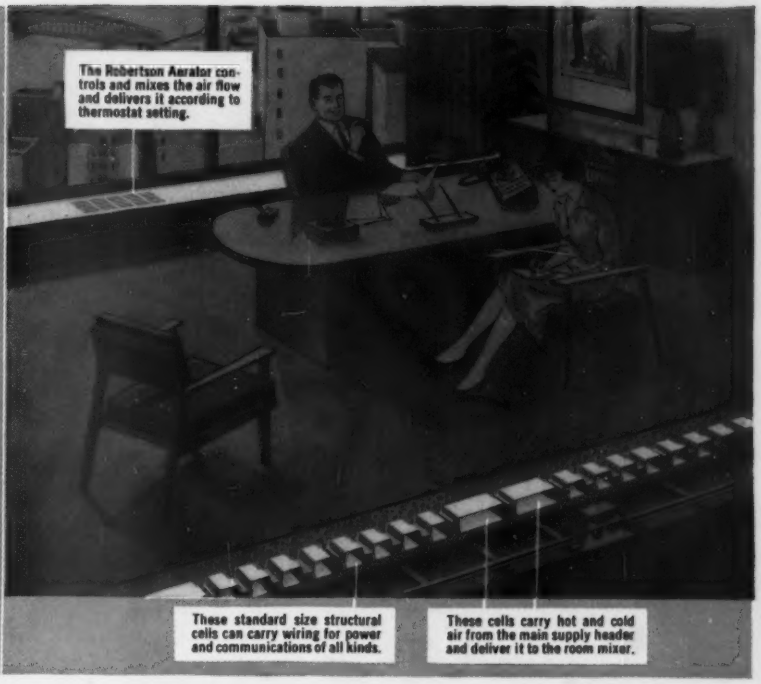
EAA also proved to be one of the thorns in the side of ESG. As a former ESG official told CONSULTING ENGINEER, EAA wanted to join the new union as a block rather than as individuals. Since this would have given EAA voting advantages, ESG insisted on individual membership.

Amann said he knows nothing of this battle. He thinks one of the primary reasons for the collapse of ESG was that it included only members on the East and West coasts, with nothing between, "and East and West never got together."

Although ESA still limits membership to engineers, the possibilities of setting up a separate group for technicians will be discussed at an August convention.

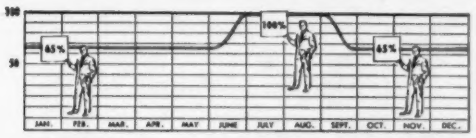
The AFL-CIO has been making much noise recently about plans to organize engineers. Amann said they cannot for two reasons — the AFL-CIO does not have the necessary personnel, and the AFL-CIO has no understanding of what en-

Cut Capital And Annual Costs With


The Robertson Aerator controls and mixes the air flow and delivers it according to thermostat setting.
These standard size structural cells can carry wiring for power and communications of all kinds.
These cells carry hot and cold air from the main supply header and deliver it to the room mixer.

Robertson Q-Air Floor system

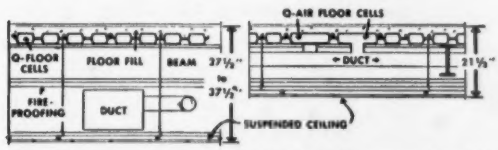
. . . increase air conditioning efficiency and save construction money



During the winter, Robertson Aerators satisfy heating requirements at 65% of peak volume.

For peak summer cooling, aerators deliver 100% volume and system runs at full power.

As cold weather approaches, changeover device adjusts system back to 65% of peak volume.



Simplified cross sections of ceiling-to-floor-above areas show old way left and Q-Air Floor right. Average compaction is one foot.

Basically, Q-Air Floor is an outgrowth of Robertson Q-Floor, the quarter-century-old cellular steel subflooring system which provides quick, efficient construction and continuous wiring raceways in more than 15,000 buildings. Within its own thickness, and without disturbing the 2-foot module of standard Q-Floor, the new system provides pairs of wide structural cells for use in connection with dual-duct, high-velocity air conditioning. These load-bearing cells are adapted by the air conditioning contractor to transport air from horizontal supply ducts to mixing units for discharge into the room.

The advantages of Q-Air Floor are threefold. The system includes the exclusive and patented Robertson Aerator, a mixing device with a seasonal changeover feature which keeps blower power at 65% of capacity except during peak summer load. Yearly power cost can be reduced as much as 30%. Since Q-Air Floor saves an average of a foot in depth per floor section, as much as 5% in building material cost can be saved—depending on the rise of the building. And this compaction inevitably results in up to an 11% reduction in overall BTU requirements.

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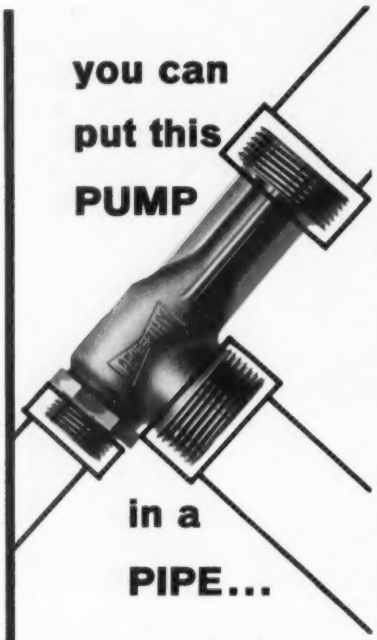
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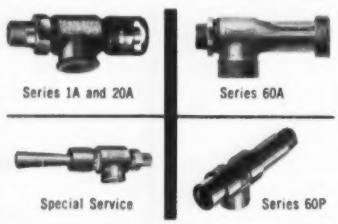

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gineers want and need. "They might hire more people, but it would take them years to change their entire approach enough to attract engineers," Amann added.

Does Amann think the National Society of Professional Engineers functional sections in industry are doing the unions any harm or giving them any competition? "No. These functional sections are management dominated, and have been consistently unsuccessful to date."

Of and For the Experts

A District Chief Justice, speaking at a symposium of the Association of Consulting Chemists and Chemical Engineers, said that the complexity of court cases involving science and engineering is getting to the point where future appeals courts probably will have staff experts. Or special courts will be presided over by technical rather than judicial experts.

"I do not approve of this, but I think it is inevitable," explained Judge John Biggs Jr., whose jurisdiction includes Delaware, New Jersey, Pennsylvania, and (for some gerrymandering reason) the Virgin Islands. Judge Biggs is no stranger to the technical specialties. He holds a degree in chemistry, and is a former DuPont employee. In explaining the complexity of modern civil suits, Judge Biggs gave as an example a recent case on which he presided. "We had 270 pages of patent specifications – two-thirds of it involving physics – and there is not a judge on the bench that could understand it without help."

The symposium also included attorneys, a district attorney, and an insurance attorney, who gave their views on the problems of and with expert witnesses.

Ordinarily, it was said, an expert is requested to appear, and is not subject to subpoena. Among the things which could make him vulnerable to subpoena are reports he might have written involving one of the parties to the court action or any endorsement of a client's project in an advertisement. In either instance, the expert could be called at the regular witness fee of a few dollars a day.

There is no such thing as an "impartial expert." Anything that involves acceptance, rejection, and selection of data reflects the educational background and the personality of the man testifying.

A plea also was issued to engineers and scientists asking that they keep technical language to a minimum in court cases. An expert's greatest value to an attorney frequently is outside the courtroom. The attorney looks to the expert for education on the technicalities involved. The expert also can help an attorney prepare questions to be asked during the trial.

Case Under Review

Engineers Joint Council, nearing the second anniversary of its request for a tax classification under its corporate status, has been notified that the case now is under review. Earlier this spring, Engineers Council for Professional Development (which applied three years ago) was granted a 501-C-3 classification. This tax grouping is for scientific, educational, and charitable organizations, and allows ECPD to be a tenant of the new Engineering Headquarters Building. EJC is hoping to be placed in the same classification.

Fund Drive Under Way

The newly organized Better Highways Information Foundation in Washington currently is in the midst of a fund drive to raise $360,000 for its first annual budget. Approximately two-thirds of this will be spent on a public relations program to "tell the people of the need for and benefits of a long-range highway program, soundly financed." Emphasis is to be placed at a "grass roots" level.

Charter members of the Information organization are the American Road Builders' Association, the Associated General Contractors, the

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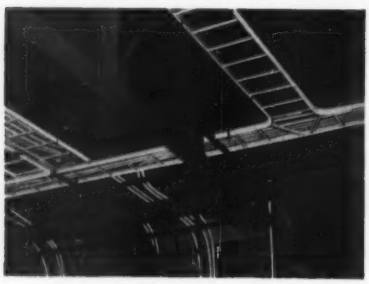

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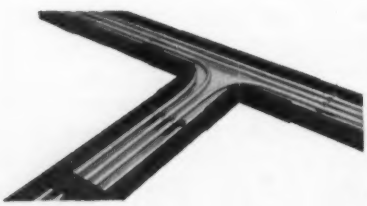

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Associated Equipment Distributors, and the Construction Industry Manufacturers Association. The latter has volunteered to raise 25 percent of the funds needed.

No More Consultants

"As a result of the critical attitude of the House Appropriations Committee last year on certain Federal agency engineering and design costs, one of them – the Bureau of Indian Affairs – changed its policy and has stopped using private consulting engineers," according to Milton Lunch, NSPE legislative counsel. The agency contended its staff could do engineering cheaper and more efficiently than could consultants. Average cost was estimated at 8 percent, of which 3.5 percent was specified as engineering and design costs. The remaining 4.5 percent was not explained.

Survey, But No Register

Some time ago, the National Science Foundation asked Engineers Joint Council to decide if a comprehensive register of United States engineers is needed, and if so, the best method of putting together such a register. After considerable study, EJC recommended that no register be compiled. It was not the initial cost that was the deterrent, but the tremendous cost of keeping it up-to-date.

However, the EJC committee now tells NSF that there is a definite need for a survey of the engineering profession. Who are the engineers in this country, and what are they doing? These would be basic survey questions.

A major survey of this type would cost an estimated $1 million. Tentative plans are for a mailing to all engineers in the nation, asking their education backgrounds, details of their past careers, and data on exactly what their current jobs entail. It is hoped NSF will contribute a portion – or possibly all – of the money needed.

Once the survey is compiled, universities and all engineering organizations could use the information to see if their current programs are serving the needs of the profession. Future policies and programs of many educational, professional, and technical groups also could be based on the findings. It also would make a superlative junk-mail mailing list.

About one year ago, the Ford Foundation was requested to help finance a sample base survey of the profession. The Ford Foundation declined, and it was thought for some time the only way to get a survey made would be to divide the areas to be covered and approach other foundations for help in financing portions of the study.

Block Listing

The Long Island Chapter of the New York State Association of Consulting Engineers is getting a special listing in the classified telephone books of Nassau and Suffolk Counties. This action was taken in an effort to help the public select consultants from the miscellaneous listings found under the "Consulting Engineer" headings in most telephone books.

New York Legislation

Out of the 4728 bills introduced in the New York legislature this year, seven directly affect consulting engineers in private practice:

Engineer-Surveyor Partnerships – For some time now, New York State law has officially allowed engineers to form partnerships only with other engineers or with architects. However, a few engineers and land surveyors have gotten together, and about a year ago, the State Education Department took notice of this trend and put a stop to it. One Long Island firm, which had been practicing as an engineer and land surveyor partnership for many years was forced to split. The Long Island Chapter of the New York State Association of Consulting Engineers, with the backing of the whole State Association, sponsored a bill to allow partnerships and

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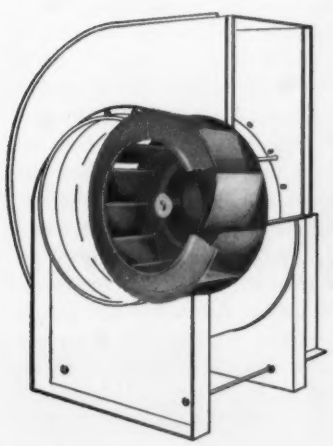

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joint ventures between engineers and surveyors, but the New York State Society of Professional Engineers opposed the bill. Usually, the two state groups agree on legislation. This bill passed the Assembly, but died in the Senate.

Employment Agencies – For some time, attorneys, doctors, and other professional groups have been allowed to operate employment bureaus through their professional associations. However, the New York law did not allow engineers, architects, and land surveyors the same privilege. NYSSPE has been operating a sort of employment service, but it was limited in scope because of this law. Now, an amendment to the General Business Law allows engineers, architects, and land surveyors to get jobs for association members. It was passed by both houses, and at last report awaited the governor's signature.

Corporate Practice – Two bills to allow corporate practice of engineering met the usual fate. Neither passed either house. One used a new approach. Since a fee would be charged under this bill for the registration of corporations, it was expected to go to the Ways and Means Committee as a revenue measure. It did not.

Employees – A bill, calling for "responsible charge," sought to allow a pupil or employee of a licensed engineer to be exempt from license requirements, only if he does *not* have responsible charge of professional engineering work. Another bill attempted to strike out a provision in current laws allowing employees or pupils of an engineer to do professional work. Combined effect of the two laws would have been to allow unlicensed employees working under registered engineers the same privileges they now have, but would have clearly set the responsibility on the registered engineer in charge. NYSSPE backed both bills, but neither passed.

Stamps and Signatures – A bill sponsored by the engineers as a companion bill to a similar one sponsored by the architects would have provided that all plans and reports prepared by engineers or land surveyors or their employees must be stamped and signed by the person responsible. It died in Senate Committee.

Penalty Bill – This bill would have provided disciplinary action by the Board of Regents against any engineer who allowed his seal to be used on plans not prepared by him or his employees. Present fines would have been doubled, and the bill also required that public officials not be allowed to accept unsealed plans. This died in committee in both houses.

Safety Engineers – "Safety engineers" would have been defined as professional engineers and allowed to become registered and licensed under this bill. It was opposed by NYSSPE, and it died in committee in both houses. Another bill, which would have granted a professional engineering license to any safety engineer who had been practicing for 12 years or more suffered the same fate.

New Electrical Show?

The American Institute of Electrical Engineers' board currently is considering the idea of holding an exhibition in connection with future annual meetings. Although there have been shows with AIEE meetings before, the national organization never has sponsored the exhibits. If AIEE decides an electrical show would be a good idea, the first could be held in 1962. Takes that long to get these things organized.

Curb Wage & Hour Rules?

The National Society of Professional Engineers has asked that the Fair Labor Standards Act be amended to give engineers the same professional status granted to doctors and lawyers. In a protest to the Labor Standards Subcommittee of the House Education and Labor Committee, NSPE asked Congress to curb "discriminatory actions

News about

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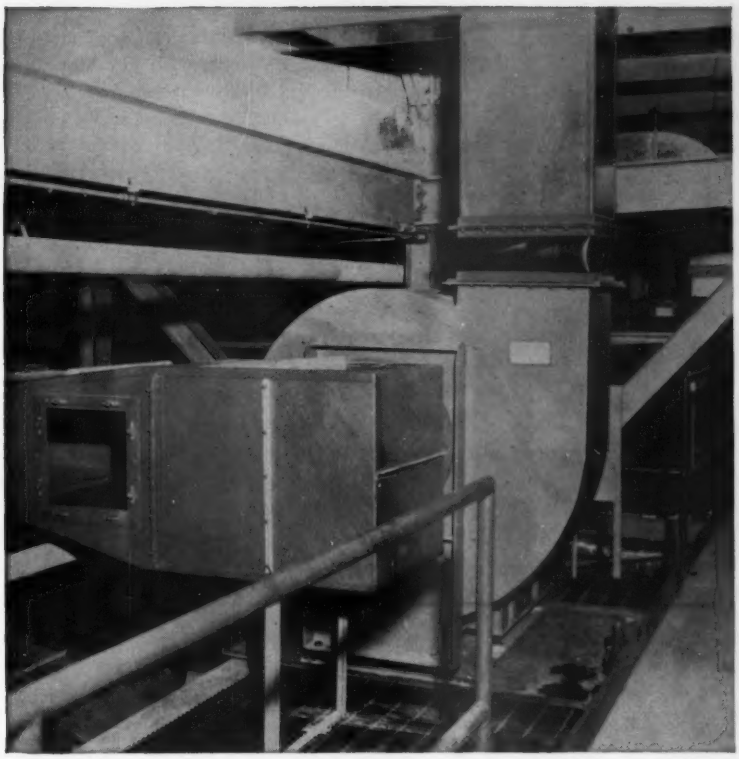

Electrical manufacturer ends corrosion problem

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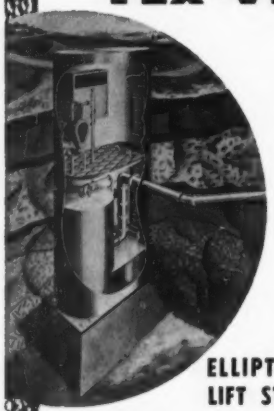

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toward professional engineering, and to extend to that worthy endeavor the same professional status and recognition accorded law and medicine."

Currently, the "salary test" states that engineering employees must earn at least $95 a week to be classified as professionals. This test does not apply to attorneys or physicians engaged in the practice of their professions. Let's not discriminate against underpaid engineers!

Jersey Society Meets

Biggest policy decision of the Consulting Engineers Functional Section of the New Jersey Society of Professional Engineers this year had to do with membership requirements. Who would be eligible to join?

After studying policies of Functional Sections in Arizona, Idaho, Indiana, Kansas, and Wisconsin, the New Jersey group decided to limit membership to principals in consulting firms. The principals also must be members of the New Jersey Society of Professional Engineers. Having made this decision, the next question was to define a consulting engineering firm. This proved more difficult. The section voted to decide each applicant's case on its merits, with a two-thirds approval of the present 59 members needed for acceptance.

The membership requirements, along with a change of name to "Consulting Engineers of New Jersey (A Functional Section of NJSPE)," was adopted by the group and sent to the state trustees for endorsement.

The licensing of planners still is much in the forefront, both among Functional Section members and the general membership. A bill which would have given licenses and seals to planners was introduced for the third year in New Jersey. Contending it would give planners a "toehold in the field of engineering," NJSPE had opposed the bill. To the engineers' surprise, the bill passed the Assembly and was sent to Senate committee. There, they have been assured, it will rest for the year. However, the engineers have been warned that next year's best defense would be a good offense. A suggestion that the engineers' registration law be expanded to provide a section for the licensing of planners was referred to committee.

The McCamy case also was mentioned. This is the case in which New Jersey architects brought charges against an engineer claiming he had been practicing architecture illegally. The case developed into a lengthy attempt to define architecture and engineering and has attracted nationwide attention. In January, Herbert Taylor, engineer member of the special board hearing the case, died. Hearings may resume sometime in June. NJSPE is conducting a fund drive to help defray costs of the hearings.

In the Functional Section meeting, the ethics committee reported collecting telephone books from all over the state. An estimated 140 "questionable" firms are listed under the "engineering" classifications. The telephone company has told the engineers that it cannot refuse yellow page listings to anyone unless it receives a notification from a law enforcement agency.

The fees committee also announced a revision of the *Manual of Information on Professional Engineering Services and Fees.* The foreword has been revised in order to present a better introduction of the consultant to the prospective client. The fee schedules also have been revised for clarity. A committee currently is working on the preparation of a recommended form of contract.

David A Wiseman was named Functional Section chairman to succeed Bill Baumann.

During the general session, NJSPE board members tried to decide whether exhibitions will be held in connection with future meetings. As President Edward B. Kirby explained, "Exhibits too often

COMBINATION STARTERS IN SPIN-TYPE ENCLOSURES

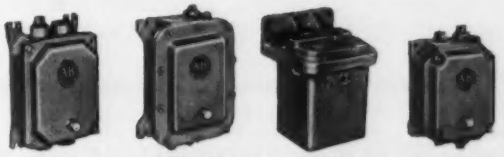
Here's Allen-Bradley's Bulletin 713 combination starter with circuit breaker—featuring conveniently removable spin-type cover and base—for use in hazardous gas and dust locations. Inside you'll find the time-tested A-B Bulletin 709 solenoid starter.

The consistent reliability of Allen-Bradley solenoid starters is a result of their design simplicity. With only ONE moving part, there's virtually nothing to go wrong—this is your assurance of millions of trouble free operations. In addition, the double break, silver alloy contacts are *always* in perfect operating condition—and remain so with *no* service attention. Also, all A-B starters have two permanently accurate thermal relays that protect motors against dangerous overloads. The reliability of these relays is not affected by atmospheric conditions or the length of time in service.

To insure maximum production with minimum maintenance, insist on Allen-Bradley *quality* motor control. Please write for full information.

Cutaway of Enclosure
Shows Allen-Bradley combination starter. Screw-type cover and base permit quick access to the starter or the circuit breaker.

A-B Bulletin 713 Combination Starter



NEMA 4 Watertight Weatherproof
NEMA 7 Hazardous Gas Locations
NEMA 8 Corrosive Hazardous Gas
NEMA 9 Hazardous Dust Locations

These enclosures remain available. Because of the trouble free operation of Allen-Bradley control, bolted covers are not a problem.

Allen-Bradley Co., 216 W. Greenfield Ave., Milwaukee 4, Wis. In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

ALLEN-BRADLEY Member of NEMA — *Quality Motor Control*

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Your systems' sentry, Scam De-Line annunciators, now offers a new MAGNA-PLAC nameplate which provides a full 10½" of engraving area—70% more than conventional nameplates.

MAGNA-PLAC gives engineers increased area to more accurately describe condition variations or to employ larger characters for greater visibility. MAGNA-PLAC is interchangeable with standard Scam nameplates and optionally available on De-Line units *without extra charge*.

Other De-Line features include side by side or stack mounting for practical, *economical* system expansion; a single plug-in relay for both normally open *or* normally closed contacts; and sequence options *after* installation.

Yes, continuous product improvements such as MAGNA-PLAC, flexible application, ruggedness and reliability are what make De-Line the engineer's annunciator.

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WRITE FOR MORE INFORMATION on De-Line MAGNA-PLAC. Just sign and attach coupon to company letterhead.

NAME _____

control when and where we hold our conventions. It is not where we *want* to meet, but where we *have* to meet." Discontinuing exhibits would mean raising dues (recently increased to $12). This was referred to committee.

NSPE President Harold A. Mosher gave a progress report. He predicted that New Hampshire and Kentucky organizations will join NSPE at the annual meeting in Boston, giving NSPE chapters in all 50 states.

"Erroneous and Misleading"

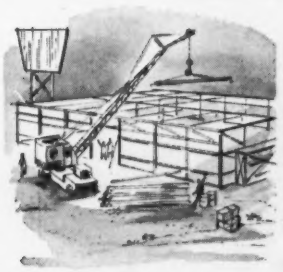
Paul Robbins, executive director of the National Society of Professional Engineers, has stated that the Comptroller General gave a House Subcommittee "highly erroneous and misleading" advice concerning consulting engineers. In a statement to a House Appropriations subcommittee, Robbins took issue with recent testimony of Comptroller General Joseph Campbell during which he made the statement that "the extensive use of consulting engineers substantially and unnecessarily increased the cost of that engineering."

Robbins said NSPE objects to "blanket statements of the type resorted to by the Comptroller General in the absence of any attempt to offer documentation or evidence to indicate that the use of state employed engineers for similar work is less expensive to the state or Federal government."

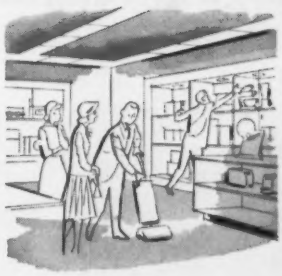
Attention also was called to the Federal-Aid Highway Act, which "clearly authorizes the use of consulting engineers."

Electricals Redistricting

The Board of Directors of the American Institute of Electrical Engineers has created a 15th district by splitting its Southwest district. The Southwest district now includes New Mexico, Texas, and a portion of Louisiana, while a new Mid-America district encompasses Kansas, Missouri, Oklahoma, and Arkansas. ▲▲



One-story construction?



Floor space valuable?

Don't want long runs of ductwork?

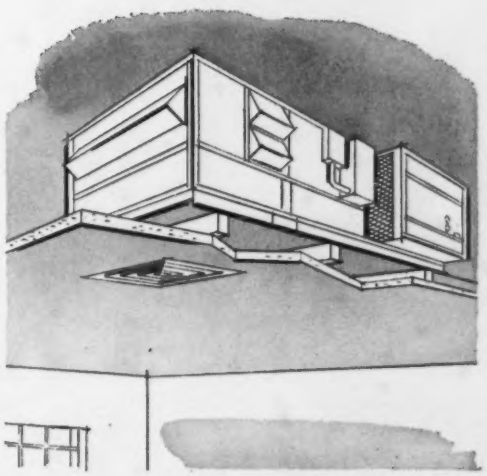
9 times out of 10 this is the most economical way to heat and cool a one-story building!

With the new Carrier Commercial Weathermaker*, year-round air conditioning can be designed and installed more economically than ever in one-story commercial or industrial buildings. It isn't necessary to give up an inch of valuable floor space, because this Weathermaker unit installs on the roof. And it isn't necessary to install expensive and unsightly ductwork, because the unit connects directly to a ceiling air grille. Notice the application here.

This unit is also designed to install with a minimum of time and trouble. It needs no water, no refrigeration piping, no charging with a refrigerant. One or more units can be installed as required, and with the following capacities: 7.5 tons of cooling and 200,000 Btus of heat . . . or 10 tons and 250,000 Btus. What's more, the motor-compressor is protected by a 5-year warranty.

For complete details about this Carrier Commercial Weathermaker, call the Carrier dealer near you. He's listed in the Yellow Pages. Or write Carrier Corporation, Syracuse 1, New York.

*Reg. U. S. Pat. Off.

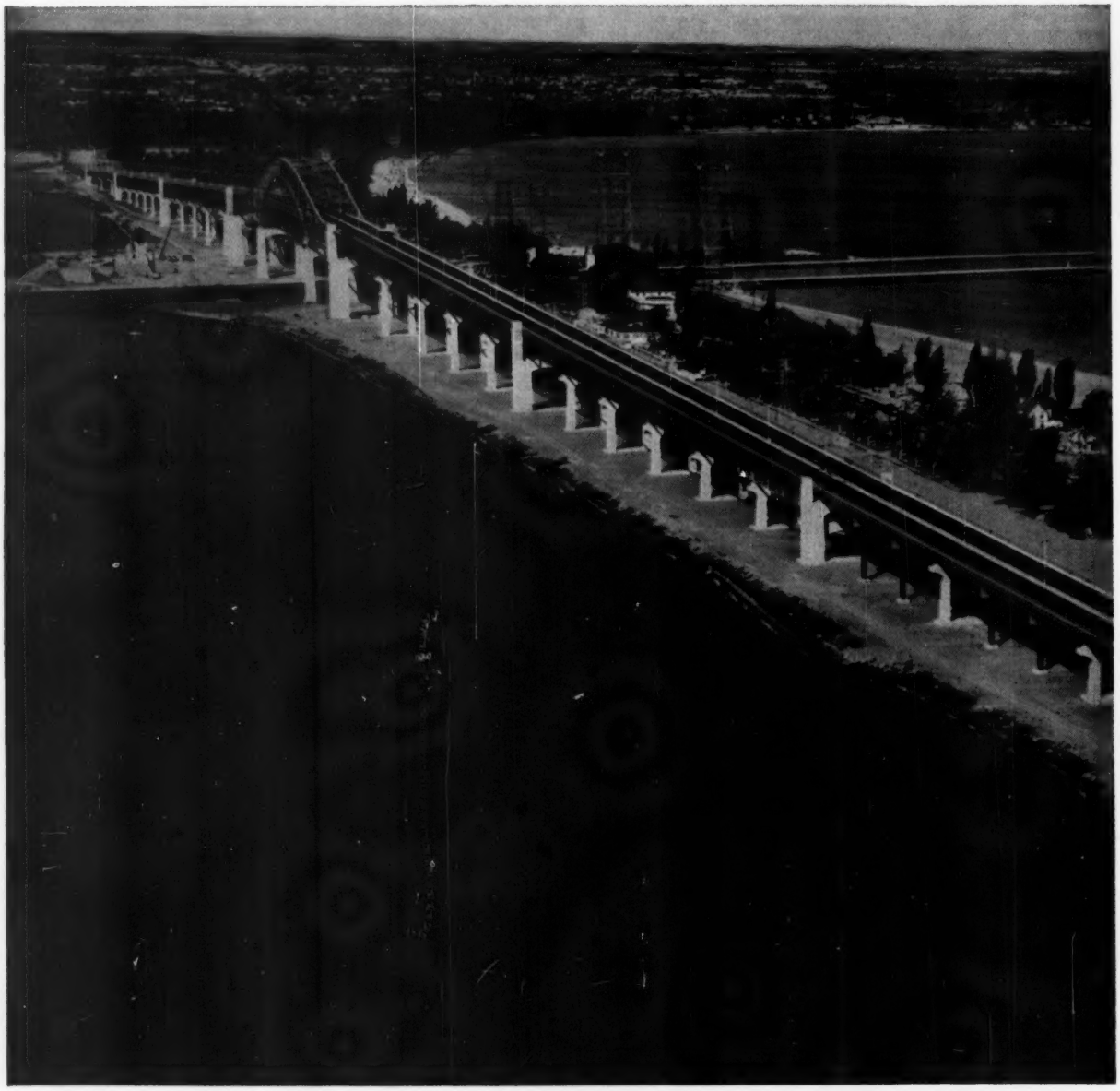


This Carrier 48B Commercial Weathermaker puts both the heating and cooling plant in the most economical of locations—the roof! It is supplied ready for fast one-unit installation. It is factory charged with refrigerant, equipped with refrigeration piping and quickly connected through the roof to a ceiling air grille.

BETTER AIR CONDITIONING FOR EVERYBODY EVERYWHERE

Carrier

USS MAN-TEN High-Strength Steel saves 600 tons

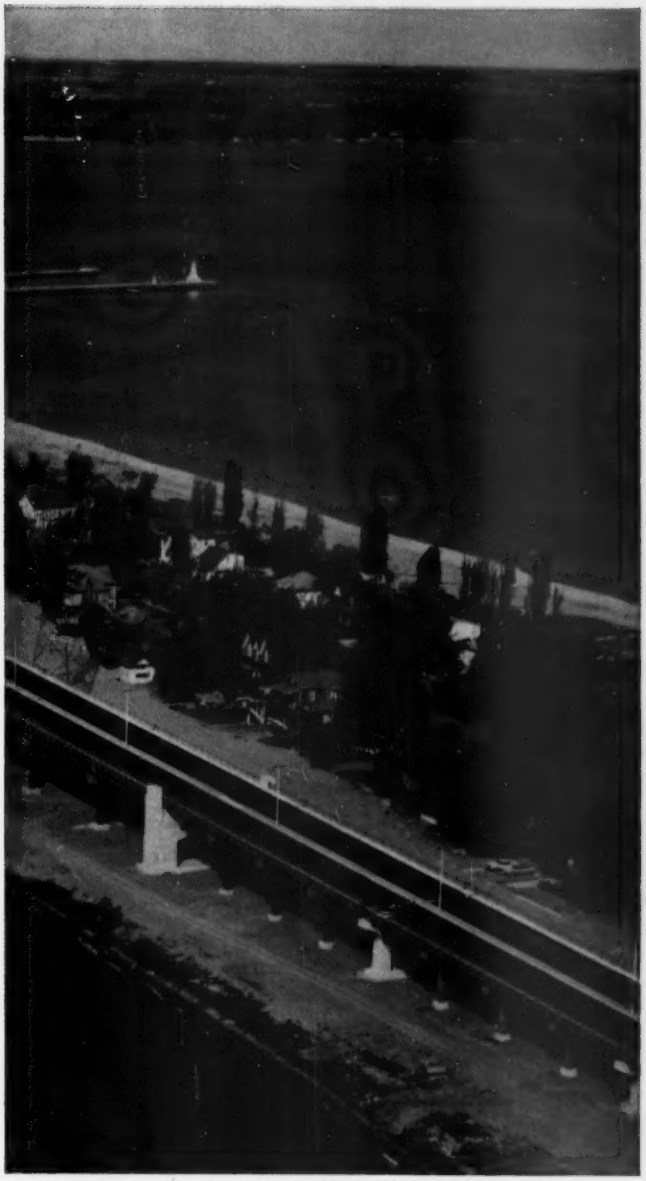


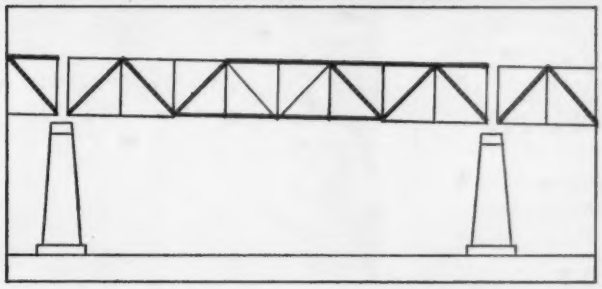
Burlington Bay Skyway. Owner: Ontario Department of Highways. Designer: Foundation of Canada Engineering Corporation Limited. 22-span fabricator and erector: Runnymede Steel Construction Limited.

3,000 tons of USS MAN-TEN High-Strength Steel were used in 22 deck-truss type spans to reduce weight and costs of the Burlington Bay Skyway. MAN-TEN Steel is shown in color in the typical deck-truss span drawing at the right. Because each truss for the 250-foot spans weighed 110 tons rather than 130 tons, it was possible to erect a complete truss in one piece with only two cranes. This materially reduced erection costs.

New color movie available—"Challenge at Carquinez." A 27-minute, 16mm. color film showing the design and construction of the unique Carquinez Straits Bridge. Ideal for engineering groups. For booking information, write United States Steel, Pittsburgh Film Distributing Center, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

# of dead weight in Canada's longest bridge structure





Canada's new Burlington Bay Skyway breaks a serious traffic bottleneck between the city of Hamilton and the town of Burlington at the west end of Lake Ontario. The entire roadway, totalling 8,400 feet in length, is really an elevated four-lane highway with 75 distinct spans. At its peak in the massive central section, the skyway towers 210 feet in the air. It accommodates 50,000 cars per day . . . cost $13.5 million.

How High-Strength steel saved weight and money. All 75 spans were first designed to use carbon steel. Then, in order to reduce costs, cut weight, and still retain the needed strength, 22 deck-truss type spans were modified to take advantage of the higher strength of USS MAN-TEN Brand Steel. MAN-TEN Steel has a minimum yield point of 50,000 psi—50% higher than carbon steel.

98 pounds per foot saved. With USS MAN-TEN Steel it was possible to eliminate a large number of reinforcing plates and extra fabrication costs. A typical MAN-TEN Steel section weighed only 426 pounds per foot compared to 524 pounds per foot for carbon steel. This added up to a total saving of 600 tons of steel in the 22 spans. In this type of structure, each pound saved on the superstructure permits a saving of three pounds in the substructure—a total of four pounds at the footing.

Fabrication costs reduced. The use of simple rolled sections rather than built-up sections made a sizable reduction in fabrication costs of about $20.00 per ton for the average location. In addition, maintenance costs are expected to be much lower because of the elimination of extra plates and rivets.

For more information about USS Design Steels—MAN-TEN, COR-TEN, TRI-TEN Brands and "T-1" Constructional Alloy Steels, write to United States Steel, 525 William Penn Place, Pittsburgh 30, Pa.

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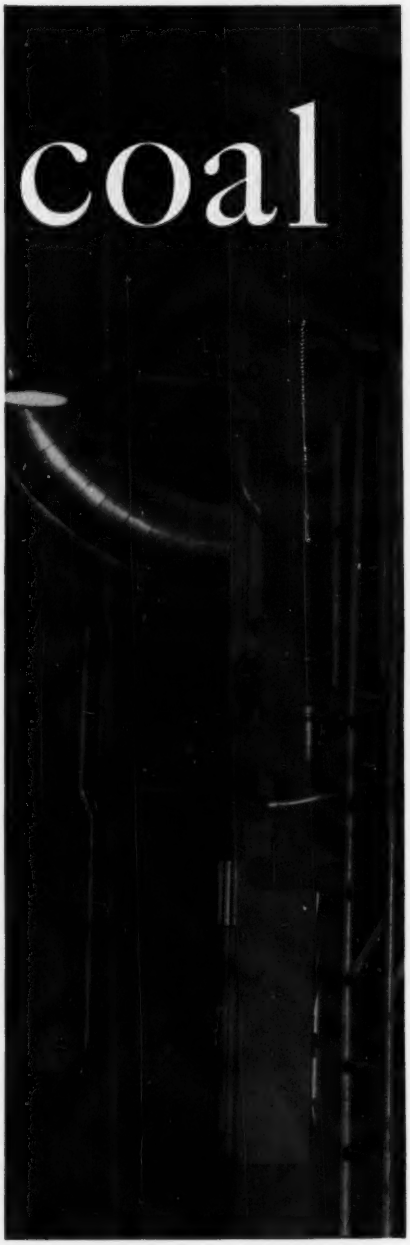
USS

Picks coal



International Paper now burns coal as low-cost fuel

When the International Paper Company—one of the largest paper companies in the country—made plans to double its production output, at its Mobile, Alabama plant, an engineering survey was made of power and steam facilities. This study indicated the need for increased boiler capacity. It was decided to install new modern coal-burning equipment.

Coal was chosen when estimates pointed up its low cost compared to other available fuels. And, for full use of coal's inherent energy content, the new power plant utilizes the latest in coal-handling and combustion equipment. Burning coal the modern way continues to pay off in steam generating efficiency and substantial fuel savings for International Paper.

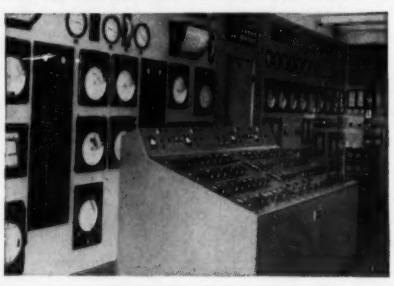
Coal is lowest cost fuel

Today, *when the annual cost of fuel often equals the original cost of the boilers,* you should know that bituminous coal is the lowest cost fuel in most industrial areas. And modern coal-burning equipment gives you 15% to 50% more steam per dollar, while automatic operation trims labor costs and eliminates smoke problems. What's more, tremendous coal reserves and mechanized mining procedures assure you a constantly plentiful supply of coal at stable prices.

Technical advisory service

All companies planning a new power plant, or the remodeling of a present one, should consult an engineering firm on its design and construction. As a matter of fact, every Bituminous Coal Institute advertisement advises its readers to take this step. When you have such a project, our Engineering Staff will be glad to assist you in your fuel cost survey with any coal information you may require.

Hagan Boiler and Fuel Control panel regulates two 450,000 lb/hr Babcock & Wilcox boilers for complete, automatic control of steam generation. Generators and steam distribution are also controlled here. Feedwater control, Bailey Meter Co.



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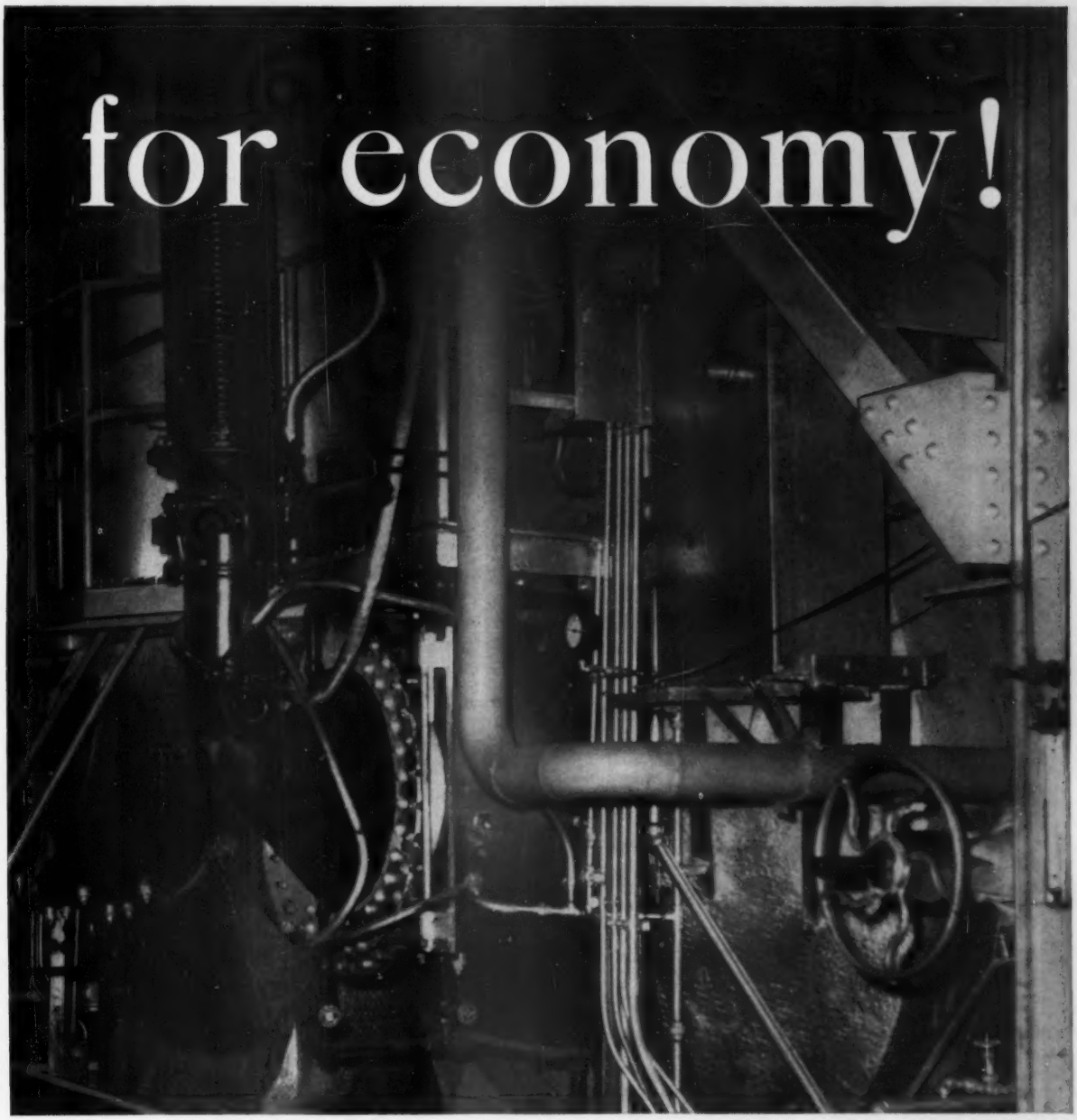
See our listing in Sweet's Files: A-30J/Bi; PE-4a/Bi; IC-18b/Bi

for economy!



View from roof of power plant showing river barge delivering coal. Harnischfeger Crane unloads barges into hopper which feeds crusher. From here, Jeffrey Conveyor on right moves coal into inside bunkers, then into 650-ton Neff & Fry silo.

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- ☐ GS-2 (high-pressure heating and/or process plant, ram-type underfeed stoker);
- ☐ GS-3 (automatic package boiler for heating and process plants);
- ☐ Case histories on larger plants.

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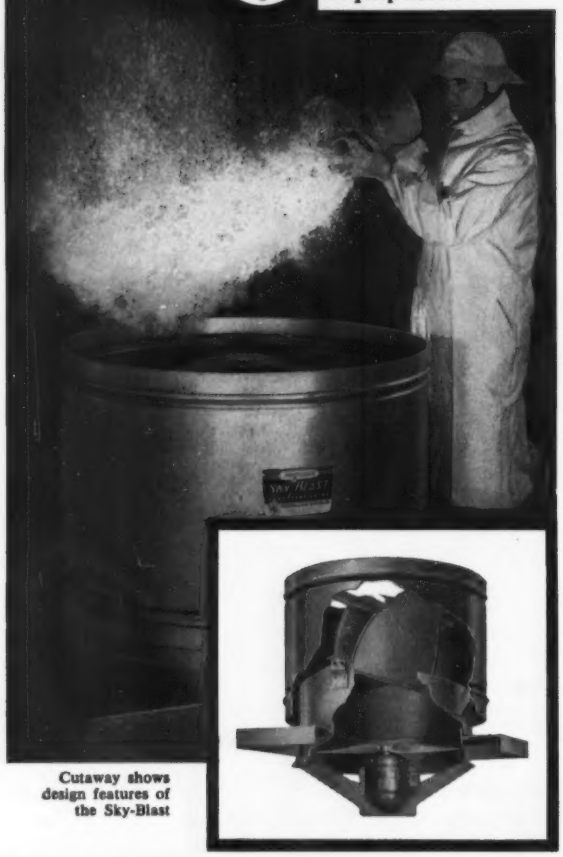
Ventilating Equipment



Cutaway shows design features of the Sky-Blast

Free-Flow SKY-BLAST® Roof Ventilators are WEATHERPROOF!

Even if the rain comes down in buckets, there's no need for weather covers on SKY-BLAST roof ventilators. In operation, the powerful airstream keeps out snow, rain and sleet. At rest, butterfly dampers form a water-tight seal, won't leak a drop. With no interfering covers, more air is moved at less cost. Fumes are thrown high in the air to prevent re-entry into the building and to eliminate roof maintenance problems created by other types of ventilators. Wind velocity or direction can't affect performance. Heavy gage steel surfaces are hot-dip galvanized for real sou'wester protection. With patented, non-clogging rainshed, low wind guard, rugged base and condensate drain, it's always fair weather beneath a SKY-BLAST. Wind tunnel proven ratings to 78,000 cfm. Send for bulletin 680—CE

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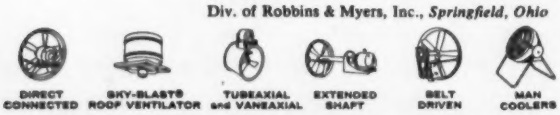

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MOVING AIR IS OUR BUSINESS®

Presenting Our Authors

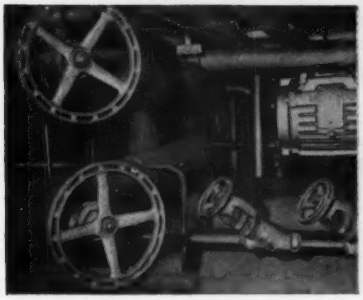
Cedric S. Carstens is a pioneer in the field of professional liability insurance. In 1946 he prepared a new broad form policy which was first issued to a large New York City architect and underwritten by Lloyds of London. In 1957 he collaborated with the Fidelity and Casualty Company in preparation of its new professional liability insurance policy, which has been sponsored by the Consulting Engineers Council.

Carstens began his insurance career as a safety engineer with Metropolitan Life and was licensed as an insurance broker in 1930. Two years later he became associated with the firm of Davis Dorland & Company, and in 1945 he joined the staff of H. C. Hauth Company. Since that time he has specialized in the construction and engineering insurance field. His article (page 98) spells out the specific areas of legal liability which court interpretations are expanding to take in the consulting engineer — whether he likes it or not.

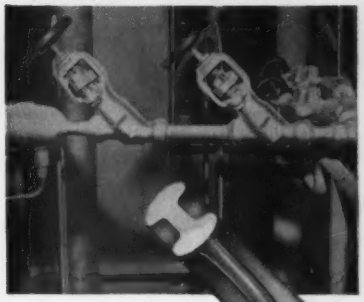
Donald R. Lueder is president of Geotechnics and Resources, Inc., a firm which is using aerial photographic methods for remote mapping of topography, geology, soils, materials, and rock on earth. Under contract to the National Aeronautics and Space Administration, the firm presently is studying these techniques for use in mapping the surface of the moon. On page 120, Lueder discusses some interesting facets of this assignment.

A graduate of Cornell, with a B.S. and an M.S. in Civil Engineering, Lueder has a broad background in photogrammetry and soil mechanics as a practicing engineer in both civil and government work, and as a teacher. He is the author of the book *Aerial Photographic Interpretation*, and has written numerous articles and technical reports. His technical society activities include work on various committees, and he is a registered engineer in several states as well as Canada. ▲▲

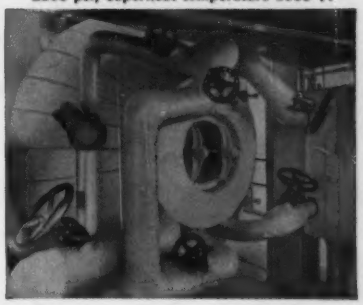
● Four of many Yarway Welbonds installed in large eastern public utility plant. Steam pressure 1850 psi; temperature 1000°F.

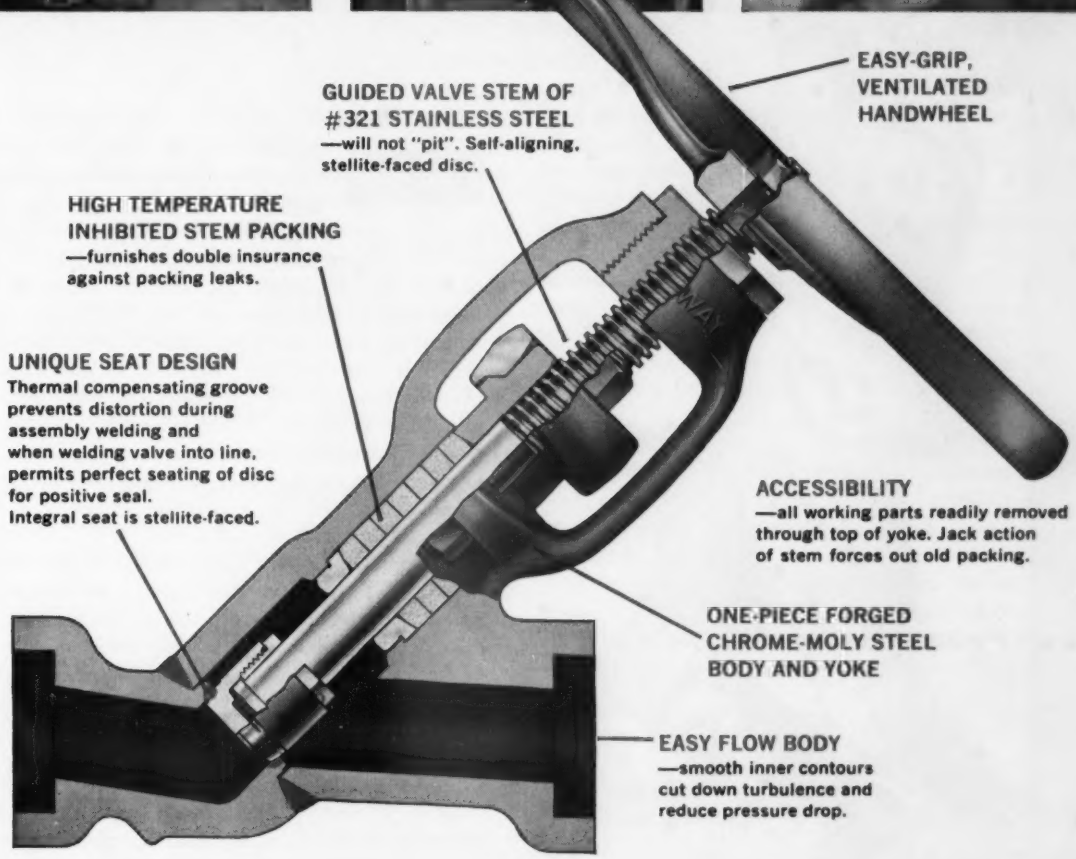


● Four Yarway Welbonds on main steam line to turbine at southern power plant. Press. 2310 psi; temp. 1000°F. Over 100 Welbonds here.



● Six of 900 Yarway Welbonds at southwest utility. Boiler drum pressure in this plant—2150 psi; superheat temperature 1005°F.

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GUIDED VALVE STEM OF #321 STAINLESS STEEL —will not "pit". Self-aligning, stellite-faced disc.
HIGH TEMPERATURE INHIBITED STEM PACKING —furnishes double insurance against packing leaks.
UNIQUE SEAT DESIGN Thermal compensating groove prevents distortion during assembly welding and when welding valve into line, permits perfect seating of disc for positive seal. Integral seat is stellite-faced.
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WELBOND valves—because they are designed specifically to provide better, longer maintenance-free service in high pressure/high temperature power plants—have won resounding acceptance from boiler room operators everywhere. WELBOND performance speaks for itself.

Look at the advantages above! Try WELBONDS in *your* plant—for high pressure boilers, in all general services requiring small valves (¼" through 2½"). Write for free Yarway Bulletin B-454.

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A MARK OF QUALITY IN STEAM ENGINEERING

They Say It's All

C. S. CARSTENS

H. C. Hauth Company, Inc.

CE *exclusive*

AN INCREASING share of current building construction cost is being diverted to mechanical and electrical equipment. For consulting engineers practicing in these fields, the result has been more intricate design and more rigid performance requirements. Meanwhile, the structural engineer has been forced to design adequate buildings, often with proportionately fewer dollars. These growing demands on consulting engineers in all fields of practice have greatly increased the possibility of performance failures. The evidence for this is readily obtainable from insurance company claim files showing payments for damages resulting from liability incurred by consulting engineer firms. Here are some recent examples.

¶ The air conditioning system installed in a large building with horizon glass exterior on two sides failed to function satisfactorily. Redesign and extensive alterations cost a very substantial sum as an extra. The owner filed a large claim for damages against the engineer when it was found that miscalculations of heat gain through the glass were the cause of the trouble.

¶ A snow melting system that specified forced circulation of hot water through coils under the driveway of an industrial plant failed to perform. It was necessary for the engineer to redesign the entire system after much of the initial work had been completed. The cost of the extra work was paid as a claim under the engineer's professional liability policy.

¶ Severe damage was caused by water overflowing from the stalls in a shower room in a college dormitory. The drains were found inadequate to carry off the water when the showers were all in use. The specifications of the mechanical engineer were found inadequate.

¶ Loads were underestimated for the chapel of a seminary when a heavy terrazzo floor was installed and a large altar and organ added. More steel was

Your Fault!

The consulting engineer may be responsible not only for his own technical miscalculations in design, but also for his failure to supervise all of the activity at the construction site.

required to reinforce the floor. This reduced the headroom in the basement so as to require excavating and lowering the floor. While no collapse occurred, the total cost of these changes in construction was heavy.

¶ The floor of a school gymnasium rotted out as the result of an underground water condition which was not discovered until the construction was completed. While some test borings had been made, they were inadequate for determining the extent of the condition. Drainage tiling was necessary, and much of the floor had to be replaced. The engineer was held liable for these damages.

Liability on Construction Supervision

Another increasing problem for the consulting engineer created by complexity of design is the reliance placed on him to supervise the work of contractors in carrying out his plans and specifications. This has imposed new forms of contractual obligation upon many engineers. Recent decisions of the courts have confirmed this by establishing considerable legal liability for the engineer in connection with damages growing out of his work. This indicates an extension of the principle of negligence to new areas in which the consulting engineer has heretofore been regarded as immune. In effect, the consulting engineer has been put on notice that he may be held accountable in a court of law for failures in performance of the work he has designed if failures cause damages to others, either through costly changes in construction or bodily injury to persons or damage to property of others.

Field activities of the consulting engineer are proving particularly troublesome as sources of negligence claims. By signing a contract calling for "general superintendence of the work," "periodic inspections at the job site," "supervision of the work as required," or similar services, the engineer assumes, often unknowingly, an obligation agreeing in effect to supervise construction of the work he has designed. He has made himself legally

liable not only for satisfactory completion of the work by the contractor in conformance with the plans and specifications and other contract requirements, but also for other implied obligations which may, under certain circumstances, be legally binding upon him.

Court Decisions

In one recent case, an engineer who had made only three inspections to check work on a new school building was sued when an employee installing ducts for the heating system fell off a scaffold which had been borrowed from another contractor. It was alleged that the engineer was negligent in permitting the use of unsafe scaffolding on the job, since he had agreed to provide "general superintendence of the work." It was held that this placed responsibility upon him to see that working conditions were reasonably safe and that equipment used on the job was not defective.

In another recent court decision a large judgment was obtained against both the mechanical engineer and the architect. On this project, a heating boiler exploded during a test and seriously injured an employee of the plumber because the safety valves that were specified had not been installed. The court upheld the charge that the engineer had been negligent because of his failure to see that all necessary equipment had been provided by the heating contractor, since his contract included responsibility for supervising the work.

Contract Reappraisal Required

These interpretations of the law by the courts emphasize the importance of a reappraisal of the legal aspects of the work of the professional engineer. Oral contracts and contracts executed by an exchange of loosely drawn letters of proposal and acceptance should be avoided. Contract forms should be reviewed by attorneys and revised to meet changing conditions and to define precisely the obligations which the engineering firm is prepared to execute on any given job. If field activities are to be limited in scope, limitations should be clearly set forth in the firm's contracts.

Some contracts include a provision specifying that the engineer shall have authority to stop construction, if deemed necessary. The courts are holding that such authority is tantamount to a power of economic life or death and carries commensurate legal responsibility. Unless the engineer is prepared to exercise complete supervision over the work and accept full responsibility for the performance of the contractor, this provision should be deleted in order to avoid damage claims.

A prominent New York City consulting engineer has added the following pertinent clause to his contracts in order to limit his legal obligations on the projects that he undertakes.

"The undertaking of periodic inspections by the engineer shall not be construed as supervision of actual construction nor make him responsible for providing a safe place for the performance of work by contractors or contractors' employees or those of suppliers or subcontractors or for access, visits, use, work, travel, or occupancy by any person."

Approval of Shop Drawings

Approval of shop drawings by the engineer, upon submission by contractors, also creates problems. Approval is likely to be interpreted as placing legal responsibility upon the engineer, if errors in the drawings later are found to be the proximate cause of damages. In an effort to safeguard themselves, the following standard clause has been adopted by some engineers in their contracts.

"Approval by the architects and/or engineers of shop drawings for any material, apparatus, devices, and layouts shall not relieve this contractor from the responsibility of furnishing same of proper dimension, size, quantity, quality, and all performance characteristics to efficiently perform the requirements and intent of the contract documents. Such approval shall not relieve this contractor from responsibility for errors of any sort on the shop drawings. If the shop drawings deviate from the contract documents, this contractor shall advise the architects and/or engineers of the deviations in writing accompanying the shop drawings, including the reasons for the deviations."

Claims Are Increasing

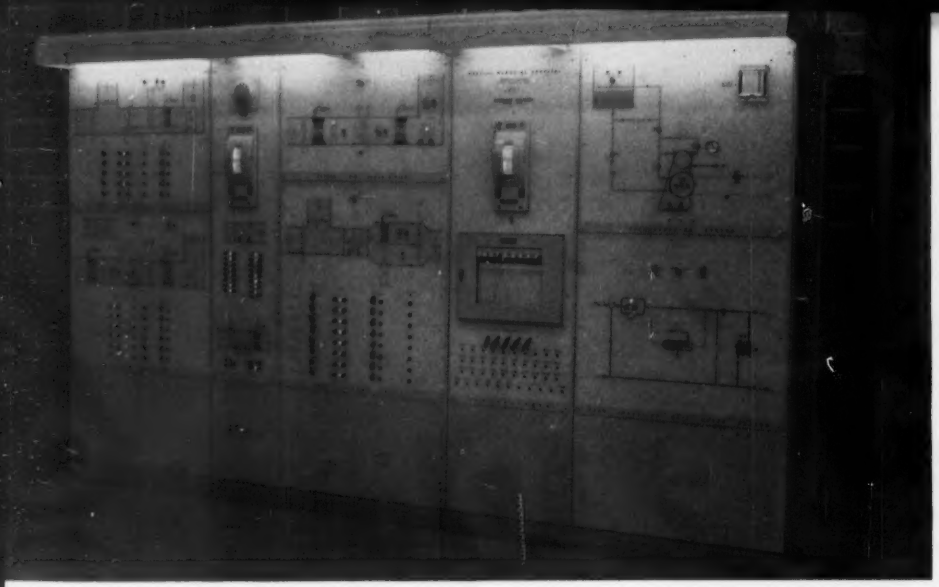
The number of claims against engineers alleging breach of professional duty has been increasing markedly during the past two years. There also has been some evidence of an increasing number of nuisance claims on construction projects in which engineers are sued jointly with others as third parties by injured employees of contractors. These suits are filed in an effort to obtain in damages sums in excess of benefits available under workmen's compensation laws, which often are inadequate to compensate fully for loss caused by the accident. While most of these actions are unsuccessful, defense costs are high.

Consulting engineers can prevent many of these claims by careful rechecking of plans and specifications on difficult jobs and by devoting greater attention to the preparation of contracts. Firms specializing in writing engineer's professional liability insurance should be called upon to assist in reviewing any contract. Frequently they can make recommendations that result in a reduction of claim frequency. ▲▲

STAFF REPORT

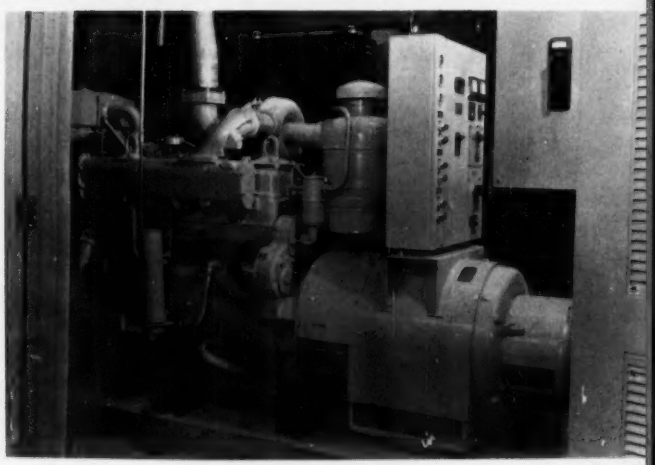
Standby Power And Emergency Lighting

- A Growing Need
- Engineering Study
- Equipment Selection
- Planned Installation
- Future Considerations



The Baptist Memorial Hospital, of Oklahoma City, is dependent on a reliable source of electric power, as indicated by the extensive air conditioning control panel. The architect-engineer firm of Coston Frankfurt and Short specified a Caterpillar standby generating system to operate boiler controls, air conditioning controls, emergency lights, operating theatres, O. B., and five elevators in case of normal power supply failure.

Standby Power And Emergency Lighting



A Growing Need

"Safety laws are not retroactive."

With this terse summation, Frank H. Ellis sets the stage for his comprehensive study* of state law and administrative regulation concerning emergency lighting. Published in 1955, it indicated that much had been done to lay the ghosts of Chicago's Iroquois Theater and Boston's Coconut Grove. But much remained to be done then — and does now.

Even though most states now demand emergency lighting in hospitals and public meeting places, this solves only one part of the problem arising when normal power sources are interrupted. For we have become so dependent on electricity that panic is always possible when it fails.

And it will fail! Probability studies made several years ago indicated that a county hospital located in a rural area, and served by a single overhead power transmission line, could expect to be without power for 30 minutes in every 11-month period. In an urban area, with multiple overhead lines, conditions were better, but there was still an average of 80 powerless minutes in every two-year period. Even in large cities with multiple underground transmission lines, 60 minutes without power was to be expected in every 4½-year period. The

*"Emergency Lighting Survey: State Law and Administrative Regulation Concerning Emergency Lighting," by Frank H. Ellis; published by the Nickel Cadmium Battery Corporation; 1955.

statistical averages are better, we can hope, today, but in specific situations they could be even worse.

People Need Light

When these power failures occur at night or in artificially lighted enclosed spaces, the first need is for light. Thus, the legal emphasis on emergency lighting is justifiable in terms of public safety. At relatively low cost, emergency lighting systems operating on battery power give people immediate psychological reassurance. In addition, they can clearly indicate danger areas, guide the way to the nearest exit, or provide interim lighting for the continuation of necessary activities.

But the problem of public safety has grown more and more complex, particularly in large cities. Tall buildings may have to be evacuated during power failures, requiring standby power of sufficient magnitude to operate at least some elevators on upper levels. Air conditioning systems may have to function for proper air circulation when large crowds are gathered, and often, in colder climates, the continuous operation of the heating system is vital to public safety. In hospitals the problem is no longer simply the maintenance of proper lighting levels. There are iron lungs, artificial kidneys, and many other electrical devices essential to life.

Industry and Defense Needs

In a world beset with large cold wars and small hot ones, the continuation of electrical service is vital to the national defense. Radar stations, rocket launching sites, and military airfields cannot function without electric power. Failure to maintain the continuity of our military communications system might mean total military defeat.

In industry, electric power failure affects not only the production processes, but also the highly sensitive communications and data processing systems that direct them. Although the problem is gradually being solved, electronic business machines and data processing equipment can lose data as a result of power failure. In some chemical plants, a single unexpected shutdown can mean days and even weeks of lost production time, not to mention serious equipment damage.

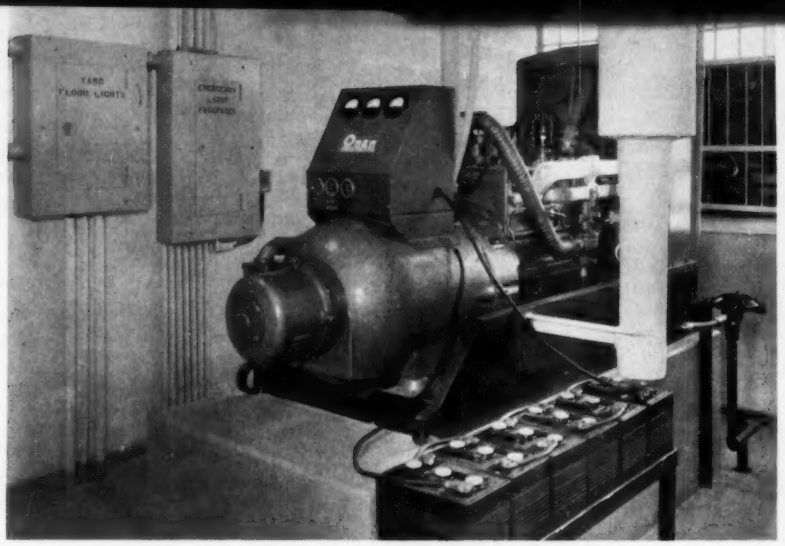
The electric utilities have done much to improve the dependability of service. However, it is impossible to avoid completely the violence of nature or the stupidity of man, and even with fewer power failures, the cost continues to mount.

¶ A one-hour power failure in a laboratory destroyed three months of work on a vital research project. A few hundred dollars invested in a simple battery powered standby system would have paid tremendous dividends even if this single power failure was the only one that ever occurred.

¶ A large insurance company installed a 750-kva standby diesel powered generating system. A detailed engineering study revealed that it would pay for itself if required for only four hours of service in a five-year period.

Abbott, Merkt & Company, New York consulting firm, included a battery operated emergency standby system in the new service building of Strawbridge & Clothier, Philadelphia department store. Total load is 10 kw, with power flowing from outside utility and from Edison batteries through a panel board that controls 4 lights on each floor. Automatic changeover switch puts load on batteries when the normal power fails.

Standby Power And Emergency Lighting



Dauphin County Prison has a 35 kw, 115/230 v, 3 wire, single phase, gas operated emergency generator set of Pennsylvania approved type. Unit was specified by consulting firm of Gatter and Diehl and supplies emergency lighting both inside and outside the prison as well as current for operating electrically controlled cell blocks and other equipment.

The Engineering Study

Engineers are well aware of the need for standby power and emergency lighting. This is clearly demonstrated in a variety of codes and standards. Unfortunately, this cannot be said for the general public, except in the emotionally charged atmosphere following a major catastrophe. It was not too long ago that Massachusetts law permitted the use of kerosene lamps for emergency lighting devices – in complete disregard for the legend of Mrs. O'Leary's cow. Today, Massachusetts has extremely rigid emergency lighting laws – passed in the wake of the Coconut Grove disaster.

Thus, the consulting engineer may find himself either in the position of having to sell his client on paying for something that is good for him, or trying to design a standby system within the narrow boundaries of rigid legislative limitations and within the confines of his client's rigid budget as well. However, legal requirements are more often than not subminimum, so it is largely up to the consulting engineer to design for a proper balance between safety and economy.

The State of Pennsylvania has rigid requirements covering the provision of emergency lighting in certain types of buildings. They are primarily interested in hospitals, schools, auditoriums, theaters, and other public buildings. However, they also have requirements for department stores, restaurants, night clubs, and similar establishments.

These are all set forth in regulations which are issued by the Department of Labor and Industry, Buildings Division, and are covered by statutes which have been in force for many years.

Not only does the state have jurisdiction over the type of building requiring emergency lighting, it also has special requirements covering the source of emergency current. This is particularly true with emergency generators. Specifications for the manufacturer make it mandatory that the starting of an emergency generator be accomplished through a starting winding in the exciter in the case of an ac machine or in the winding of a dc generator where a dc generator is used. No separate starter is permitted on a Pennsylvania approved unit. The time required for starting and picking up full load by the generator is limited to five seconds. The amount of horsepower per kw is also specified. The charge rate for batteries, both trickle and high rate, must also meet state requirements.

Schools, hospitals, public buildings, and other locations as required by the Department of Labor and Industry must use Pennsylvania approved units, and a number of manufacturers make special units which are used primarily in Pennsylvania. However, Ohio has adopted Pennsylvania's requirements and there is reason to believe that other states will follow.

In addition to the above, Pennsylvania requires emergency circuiting throughout a building to be installed in a separate conduit system unless it is

of special approved design. The requirement for lighting is one-half foot candle per square foot in all areas requiring emergency lighting.

Standby Power Not Easily Justified

While multiple utility transmission lines, when available, provide reasonable insurance against frequent power failure, there is still a need for standby power. Unfortunately, there is no general criterion for establishing the requirements of a specific system. In industrial processing operations, where safety is often not an important factor, it is relatively easy to determine the economic justification for a given degree of standby protection. In hospitals, to the contrary, there is seldom an opportunity for justifying the cost of the standby installation on economic grounds. It must be justified in terms of comfort, convenience, and the value of human life.

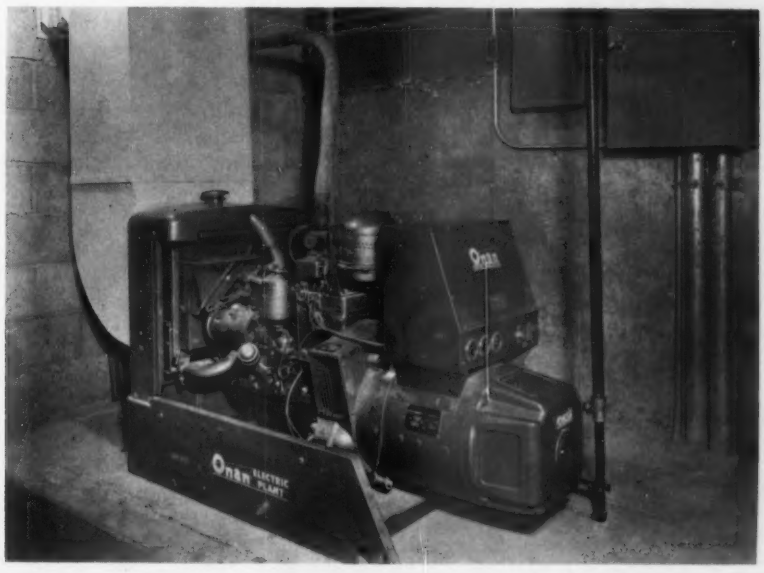
In some quarters, there is active agitation for the specification of 100 percent standby service in hospitals. In contrast, some hospitals now being built are equipped with little more than emergency lighting from flashlights. In between stands the American Hospital Association, which plans to publish its own recommendations on standby power and emergency lighting for hospitals early in 1961. At present, the Association has not established its position, but indications point to a recommendation of standby power for considerably less than 100 percent service.

H. Fay Diehl of Gatter and Diehl states that it is up to the consulting engineer to determine the minimum amount of equipment that should operate during a prolonged outage to provide minimum operation for the hospital. In many instances decisions will have to be made by the consultant since he may be more familiar with the mechanical operation of the hospital than the superintendent or the maintenance engineer. Normally the minimum requirement for a hospital is to keep the heating plant and all boiler auxiliaries in operation. However, in most instances a single boiler will provide minimum heating. In addition to the boiler and its auxiliaries, it is also necessary to include vacuum return or circulating pumps in all buildings, sump pumps where lack of pumping may flood basement areas, and sewage ejectors where sewage has to be pumped.

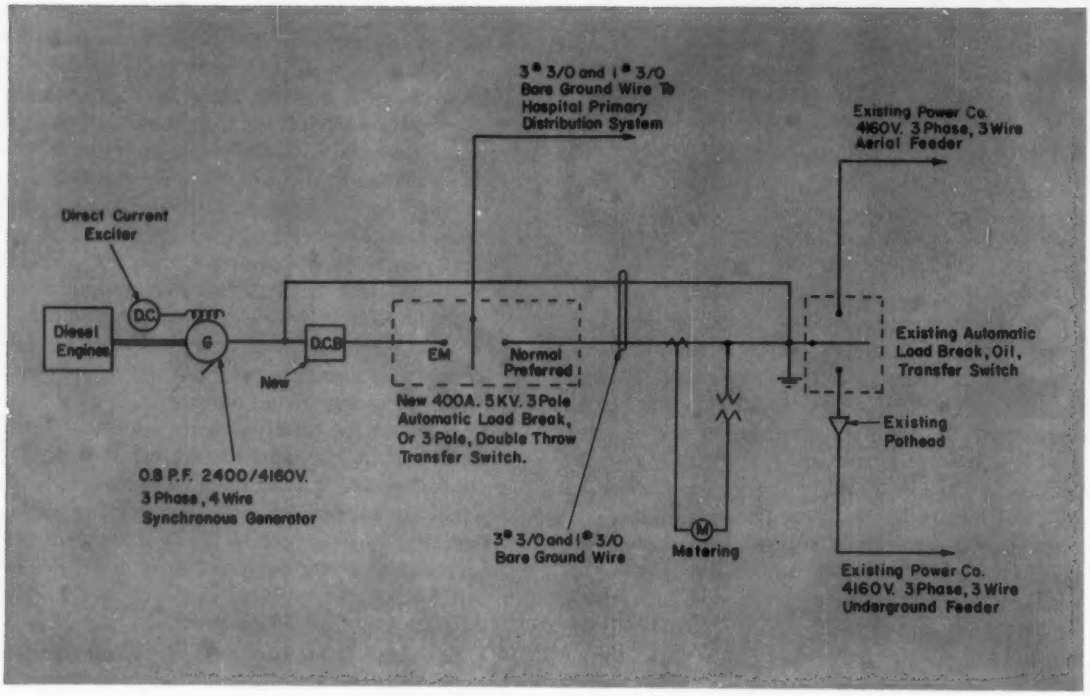
In addition, at least one large elevator should be included, a minimum of lighting through the corridors, nurses' stations and stair towers, operating rooms, delivery rooms, emergency operating rooms, the major pieces of X-ray equipment, the refrigeration for the refrigeration of blood banks, blood storage and antibiotics, as well as the walk-in refrigerators in the kitchen area.

It is also advisable to provide sufficient capacity to operate one or two electric ranges in hospitals where the kitchen is electric. All of these loads should be totaled and the generator sized on this basis. Some spare capacity should be provided for additional important equipment which may be added at a later date.

Civil defense activities currently are playing an important role in the selection of standby power and emergency lighting systems for hospitals and other public buildings. With Federal funds avail-



Pennsylvania approved emergency generator system specified by Gatter & Diehl is one of four units supplying standby service to 610 bed Harrisburg Polyclinic Hospital. A larger unit will replace this 15 kw unit, which presently serves the operating suite, certain corridor lights, stair tower lights, and nurses station. Larger unit will also serve X-ray suite as well as special mobile X-ray outlets throughout the hospital.



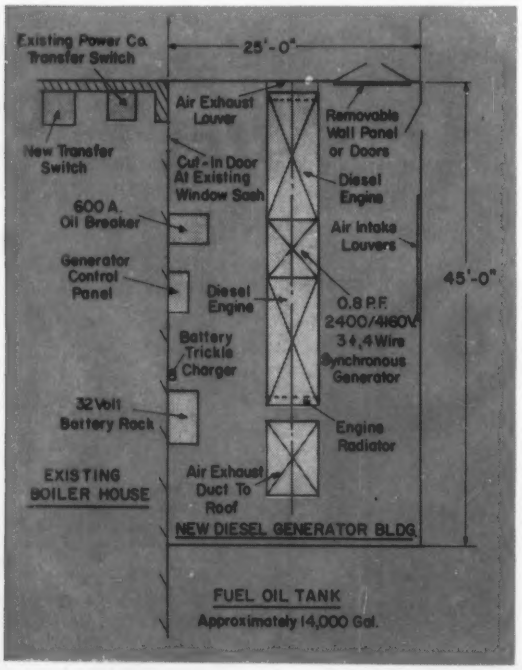


Fig. 1 — Studies by A. Epstein and Sons, Inc., Chicago engineering firm, resulted in the decision to use a single large generator for 100 percent standby power at a large midwestern hospital. By using the existing wiring system and full standby, a more economical solution was obtained than if multiple units and special emergency wiring systems had been used for standby service.

able to cover 50 percent or more of installation costs, the disaster aspect of the problem is dominant. Thus, a Midwestern high school is installing an emergency battery system which will provide power to an area of the building that will serve as a fallout shelter for the entire school population for a minimum of three days. Obviously, this far exceeds the requirements of emergency lighting created by typical power outages. Many hospitals are being similarly equipped with engine-generator sets of far greater capacity than would normally be required for conventional emergency service requirements. The system shown in Fig. 1 is unique in that its 100 percent standby system is not only a desirable feature from the point of view of civil defense but is also the most economical system possible under existing conditions.

Typical Industrial Problems

In its work for the synthetic fiber and glass industries, Lockwood Greene Engineers, Inc. has found that round-the-clock operations demand careful planning of standby facilities. In all these plants, two sources of high voltage power are required, preferably from separate and reliable utility substations. But even when this protection is available, standby systems frequently are provided. For example, one fiber glass plant was equipped with a large diesel driven electric generator with manually controlled compressed air starting equipment. Con-

trol power for equipment was maintained by flywheel generators until the standby system took over. In another plant using d. c. power from rectifiers, a 1600 ampere-hour battery system was floated on the line to take over the load when utility power failed.

Lockwood Greene engineers say that the continuous power demands of these plants require detailed engineering study for each specific situation. They call for a careful weighing of possible production loss against the capital expenditure and maintenance cost for additional standby facilities.

Study for a Large Building

A study of the standby power needs for a multistory building in New York City provides some interesting background on the problems consulting engineers encounter on this type of project. Initially, the client had rejected standby power, since the building was to be supplied by two independent high tension feeders from the Consolidated Edison Company distribution system. Provision had been made for the elevator system to operate with no two adjacent elevators depending on the same power service. However, with construction of the building well under way, the question of standby power was raised again with Syska & Hennessy, the consulting firm. The client had become concerned over a new regulation of the City of New York that allowed the opening of an elevator door from the outside only if the elevator stopped within 18 inches of the floor. With a bank of 30 passenger elevators, it was obvious that if a power failure occurred, at least some of them would not meet this condition. An additional economic factor was involved, for this building also was to house the central teletype system of a large corporation. Loss of the teletype, even for a few hours, would prove extremely costly.

Working with the client, Syska & Hennessy first established the minimum generator capacity required and a general sequence of operation to be used in event of total power failure. The load was based on the power requirements for one freight elevator and one passenger elevator, the emergency lighting system, one sewage ejector pump, and lighting within the elevator cars. To permit the elevator operator to control emergency operations, a supply connection to his panel was to be provided from the standby system.

In the event of total power failure, the generator system would start automatically. Emergency lighting would take over automatically, but manual control would be used for supplying emergency power to the elevators and the sewage ejector pump. The most important operation would be the freeing of passengers trapped in the elevators. Individual elevators would have to be operated one at a time to bring passengers to the lobby.

With these conditions established, it remained for Syska & Hennessy to select the proper equipment. On other projects they had considered the use of steam turbine powered generators, but found the power company reluctant to approve this type of installation in New York City. Thus, because of the demand for between 200 and 300 kw, they decided to use a diesel engine driven generator system. In the city, diesel fuel has the advantage of being less rigidly restricted as to location of storage facilities than gasoline.

There remained the problem of locating the generator system and the establishment of an efficient method of using the elevators on emergency power. Six schemes were developed, two of which called for locating the standby plant on the 51st floor of the building, the remainder proposed that it be in the subcellar. Except for one scheme, costs were generally comparable. The lowest cost, achieved by making greater use of existing wiring, was objectionable because of the fact that it also entailed a longer evacuation time. The alternatives involving placement of the standby system on the 51st floor also were eliminated, even though they indicated slight cost advantages. The building was already under construction, and it was estimated that it would take six months to obtain permission from the Board of Standards and Appeals to use this unusual approach – if it were granted at all. In addition, the diesel engine would be in close proximity to executive offices and, though it would be a rare occurrence, filling oil storage tanks would be inconvenient.

Thus, the approach was reduced to a choice between two schemes, both of which were equally effective as far as evacuation time. Final recommendation was based on the desirability of concentrating the evacuation area. The system shown in Fig. 2 accomplishes this by allowing two freight elevators to be used for evacuation, while retaining the possibility of using one freight and one passenger elevator for the same purpose. A 250-kw, diesel powered generator was required and a satisfactory subcellar location was selected.

Syska & Hennessy engineers point out that standby power studies are best made in the early planning stages of a new project. On this particular project, the recommended scheme fitted into the existing structural system with only minor alterations. However, the structural engineers, Weiskopf & Pickworth, say that this is not typical.

Structural Problems

In the majority of installations, the structural engineer attempts to place either steel or concrete

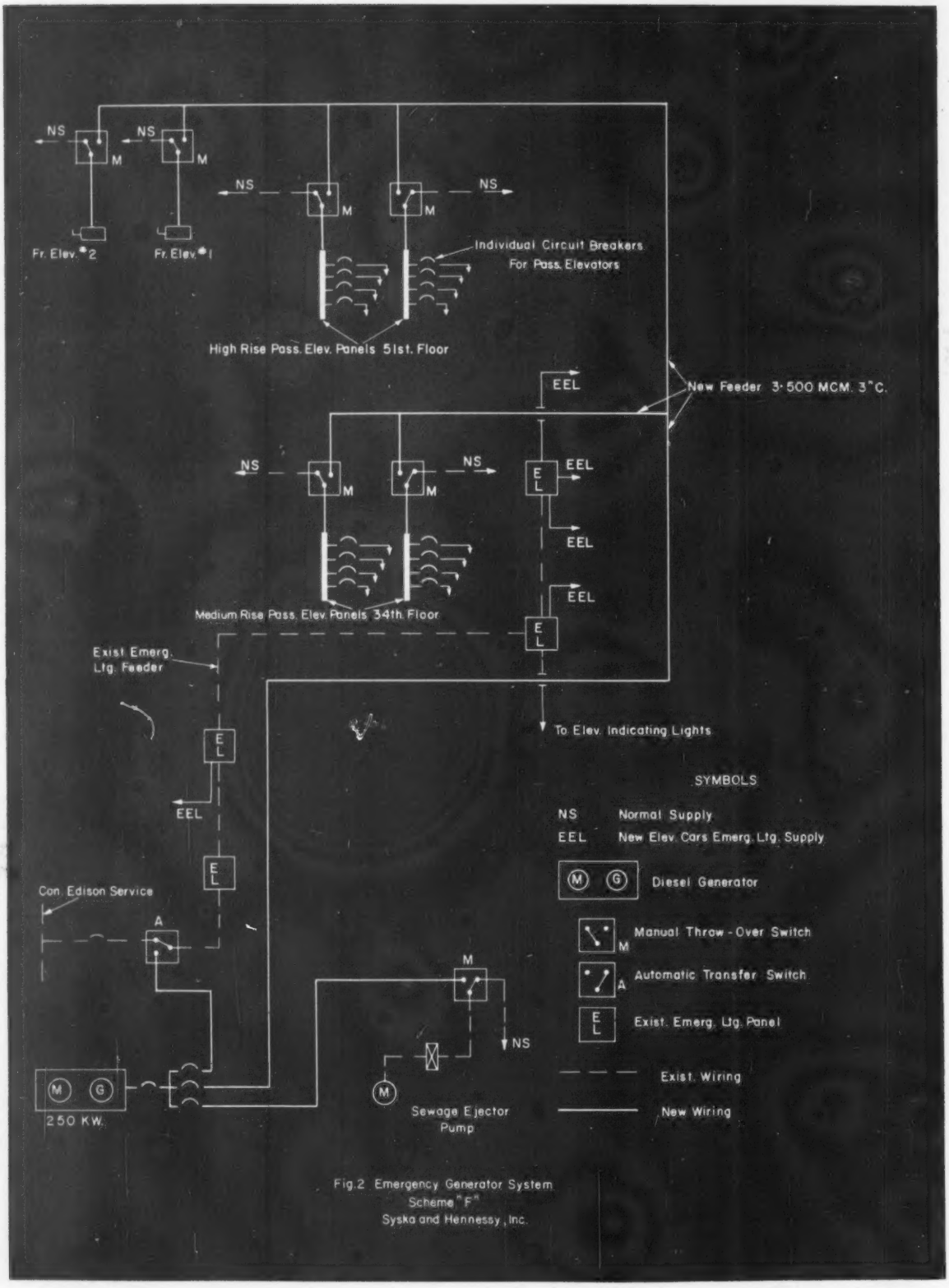
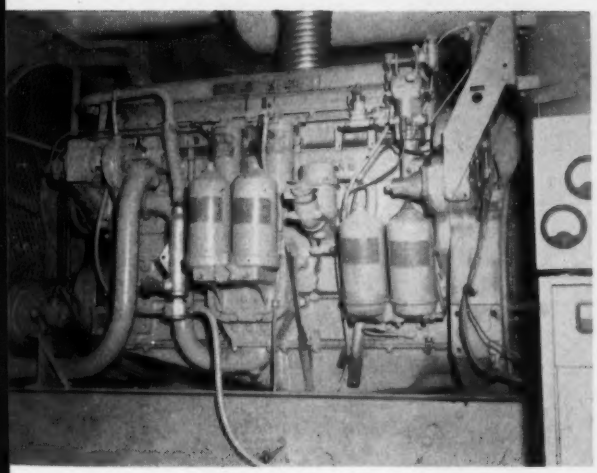
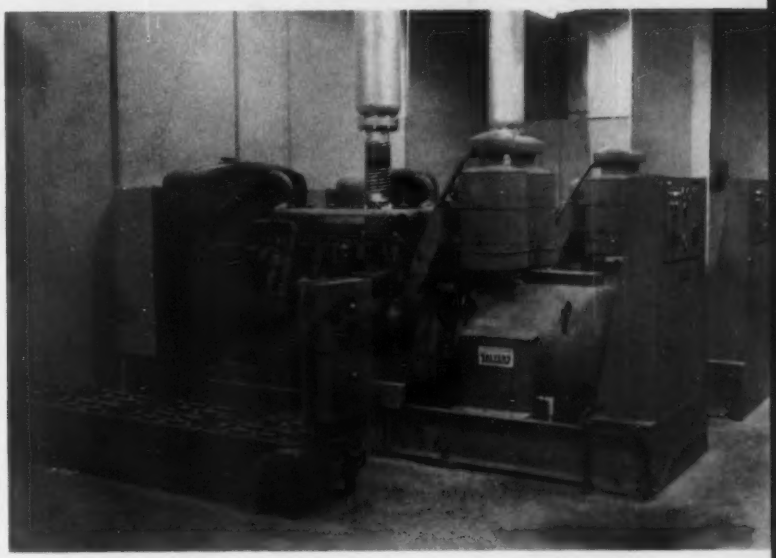


Fig.2 Emergency Generator System
Scheme "F"
Syska and Hennessy, Inc.



Standby system for new wing of San Diego's Grossmont District Hospital was designed by Charles Luckman Associates. The 170 kw unit is equipped for automatic switchover and runs for 18 minutes every third day as a check on its immediate availability.



Los Angeles County Court House has General Motors diesel units of 150 kw. System was designed by Ralph E. Phillips, Inc. to provide for both lighting and elevator loads. However, if one generator set fails to start, elevator load is not carried.

beams under the emergency generating equipment. In this way, the load receives better support, and stresses are carried directly to the columns. This is important because of the possibility of vibration loads. Normally, beams and heavy slabs combined with vibration isolators tend to dampen vibration and simplify the structural problem as well as provide more comfortable working quarters free of annoying vibration. When emergency generating equipment is installed in existing buildings, the major problem is the engine-generator set, but minor structural alterations also may be required to support fuel tanks. Rearrangement of heating and ventilating duct work, electrical conduit, and plumbing may be required.

Typical Local Studies

Engineering studies for standby power systems are, of course, strongly influenced by the history of reliability of local power service. Dudley Deane and Associates and Ben R. Lezin, San Francisco consultants, have designed a number of standby systems in their area, most of which range from as low as 5 up to a maximum of 50 kw. These installations serve a variety of structures, from hospitals to public buildings, and in most instances are intended only to handle emergency lighting loads. The reliability of utility service in the area is such that there is little justification for extensive standby power service above that required by law or codes.

An interesting exception is the Plumas District Hospital at Quincy, California. This small 30-bed hospital is equipped with a 75-kw gasoline drive generator with heating coils. Since the hospital uses electricity for both cooking and heating, it was decided to provide standby power not only for normal emergency requirements, but also for the heating load in certain critical areas.

In Los Angeles, the County Courthouse and the County Hall of Administration have been equipped with 100 percent standby systems. Designed by Ralph E. Phillips, consulting engineer, the two buildings have similar systems. Two, 150-kw generators are connected in parallel at 480 volts, 3 phase. Each generator is driven by a 2-cycle diesel engine. Automatic synchronizing equipment connects the generators into a switchboard feeding both power and lighting loads. If one generator fails to start, the circuit breakers feeding the power loads do not close and only lighting loads are served by the remaining generator.

Grant Kelley and Associates, Portland, Oregon consulting firm, has done considerable work involving standby power in both Oregon and Alaska.

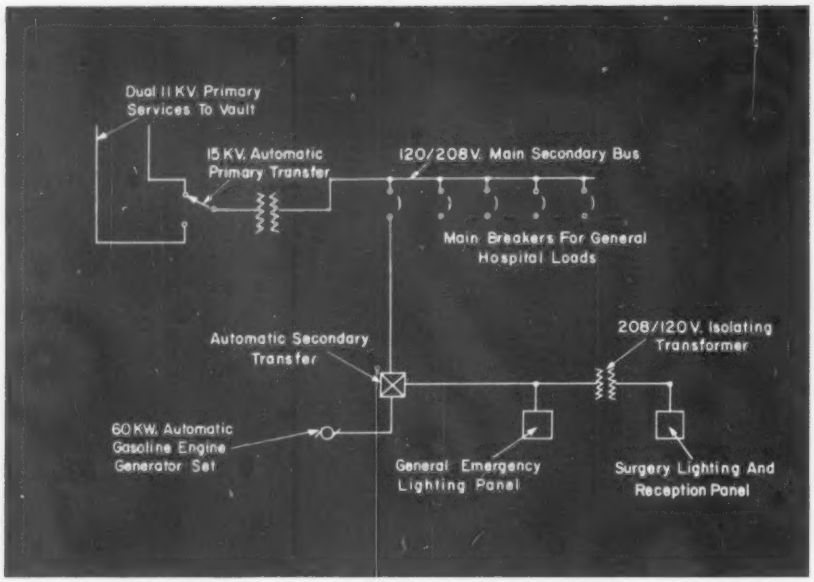
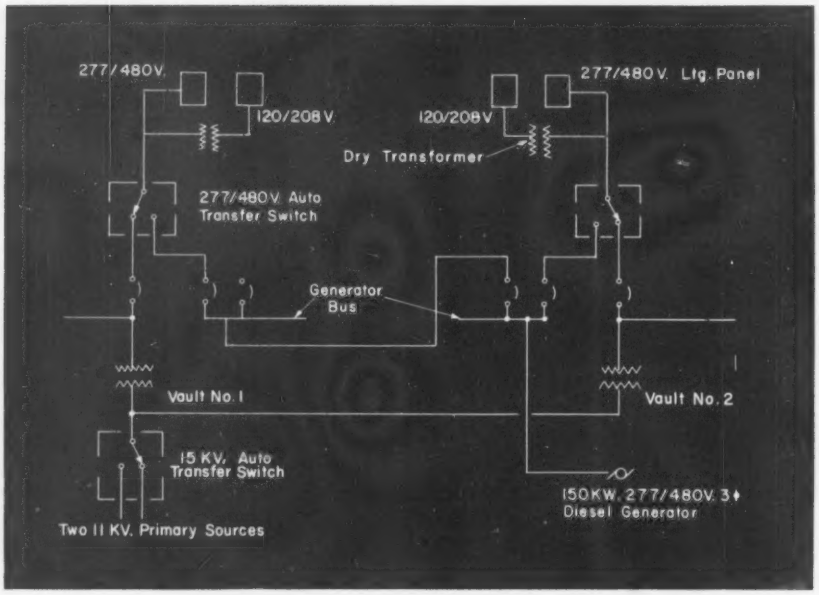


Fig. 3 Left — The Bess Kaiser Hospital has a 60 kw automatic gasoline engine generator set. Standby system was designed by Grant Kelley and Associates of Portland with primary concern for lighting.

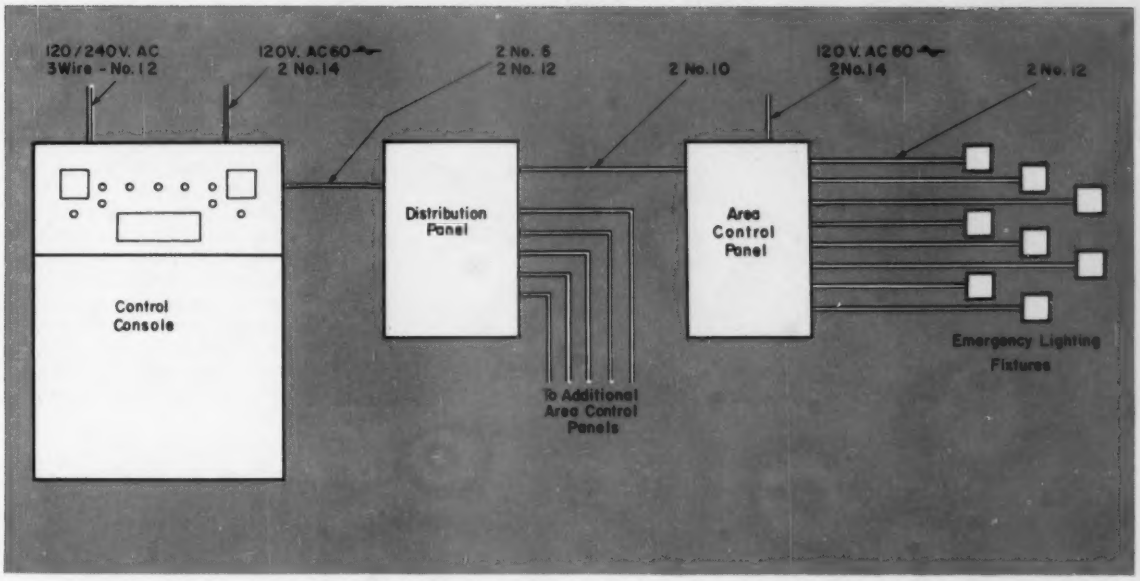


Right — Another Grant Kelley design at the Portland International Airport Terminal. The 150 kw diesel generator unit is manually started, since two primary sources are already provided, with automatic load transfer from one to the other.

Simplified diagrams of two of these systems are shown in Fig. 3. One of the major differences in designing for these two locations is the wide use of diesel fuel in Alaska. Available in a special cold weather blend, it is possible to supply heating plants and standby engines with the same fuel. So diesel fuel usually is specified.

An interesting installation at the Bethel Hospital in Alaska is solely dependent on diesel driven generators, since no commercial supply is available. Under these circumstances, three identical 100-kw, 120/208-volt, 3-phase generators are used. Machines and controls are set up for parallel synchronized operation, with two machines capable of carrying the entire normal hospital load. The third machine is thus available for maintenance or emergency standby. Use of the units is alternated to spread wear uniformly.

Standby Power And Emergency Lighting



Typical large battery powered emergency lighting system with automatic load transfer when normal power fails.

Equipment Selection

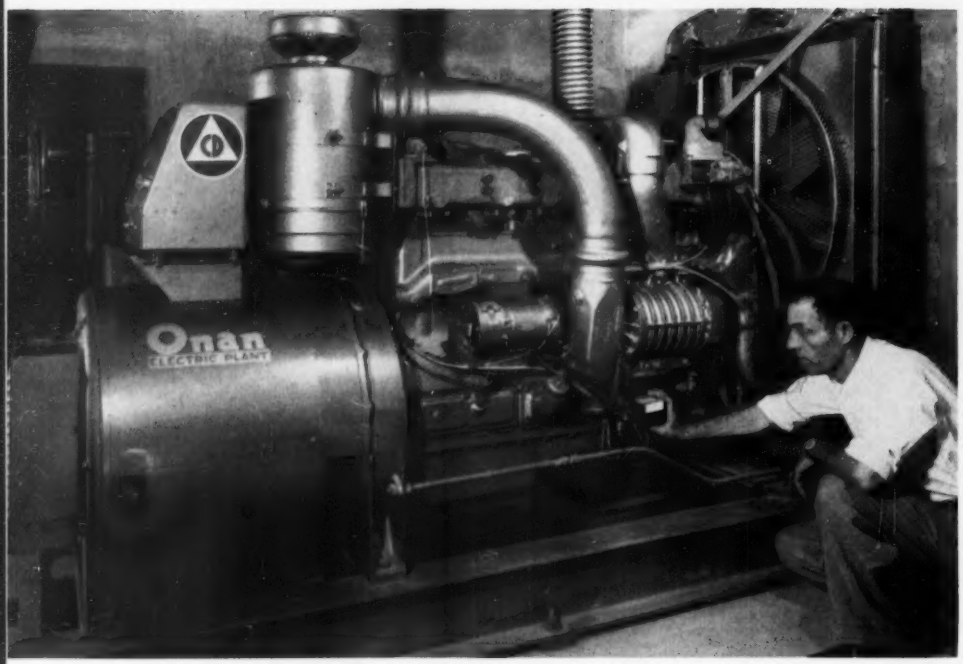
Regardless of its economic value, a rapid transfer to emergency power is important when the regular source fails. The psychological reassurance provided by uninterrupted power can contribute immeasurably to safety. Unfortunately, it is in hospitals and other institutions that the long delay hand cranking and push button starting equipment is most prevalent. In industrial standby installations, the extra cost of rapid transfer from normal to emergency can be justified by anticipated dollar savings. And in telecommunications and similar services, the need for instantaneous transfer is obvious.

Battery Systems

Within its load range, the battery system can take over emergency loads faster than engine generator systems. For example, battery systems with transistor converters sometimes are used to supply power during the short interval while engine generator sets are being started up. For light loads, such as one or two sealed beam lamps, 6-volt nickel cadmium storage battery units, which plug into a. c. wall outlets, can be installed for as little as $200. The batteries remain automatically charged and power is supplied to the lamps instantly when there is a power failure.

Battery systems can be used to supply up to 230 volts, and they can be designed to handle loads of 70 kw for an hour or more. However, additional controls and the cost of the cells themselves may easily put a $20,000 price tag on such a large system. By contrast, a gasoline or diesel unit of the same capacity would cost about half as much. Thus, it is evident that battery standby power is most practical for lighting loads and those specific situations where direct current is required.

Batteries may be lead-acid, nickel-cadmium, or nickel-iron-alkaline. The latter two, while more costly, generally can be expected to give longer service and are claimed to be less subject to ac-



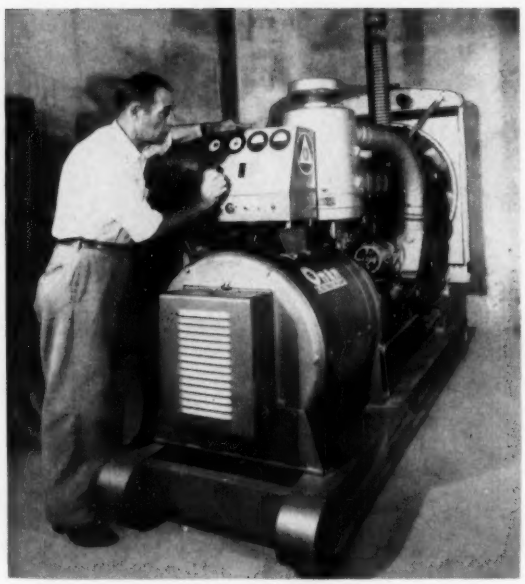
All Souls Hospital at Morristown, New Jersey, recently installed this Onan electric plant specified by Allen W. Keller. The 150 kw diesel powered unit is equipped with ASCO switchgear and Westinghouse and Bulldog disconnect panels. A 1500 gallon fuel tank provides fuel for three days operation, with loads from two elevators, boiler controls, feed pumps, vacuum pumps, refrigeration units, FA system, PA system, and emergency lighting throughout the hospital.

cidental damage. It should be noted that battery design is improving steadily, and there are some unusual applications as a result. One involves the use of a coupled a. c. motor and d. c. generator which simply reverse their roles on power failure. Thus, with normal supply the a. c. motor drives the d. c. generator which in turn maintains the charge on the batteries. When power fails, the batteries supply the d. c. unit which now becomes a motor driving the a. c. unit which becomes a generator. There also will be available shortly a battery powered emergency lighting system for the hospital operating room which will continue to feed an already lighted surgical fixture. In fact, it will provide the same foot-candle rating, point of focus, and light intensity as obtained from the normal a. c. supply. Batteries can also be used to provide a. c. power by static electronic conversion.

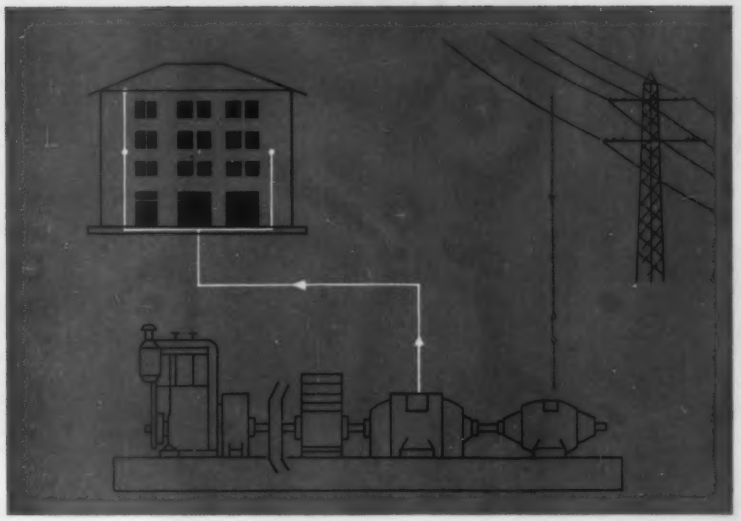
Engine-Generator Systems

Conventional engine generator sets must, of necessity, delay the transfer of power service from normal to standby long enough to get the engine started and up to speed. Hand cranking and hand operation of transfer switches can take several moments. Push button control of battery powered starters may reduce this time element to under a minute, while automatic starting cuts the switchover to a matter of seconds.

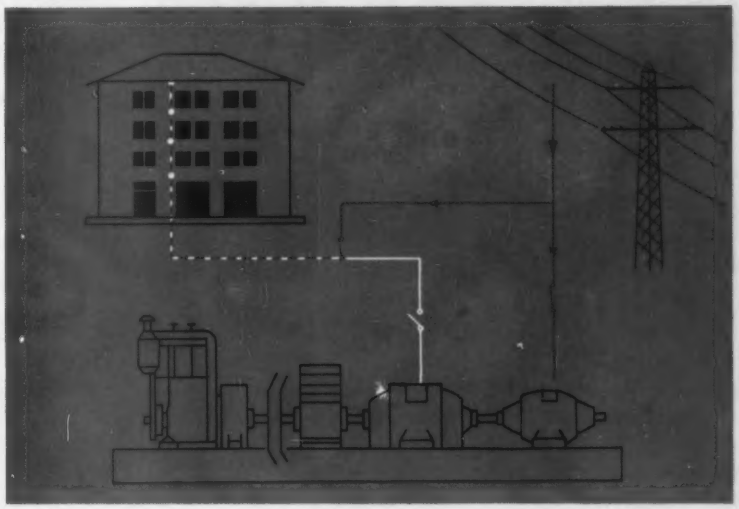
A German manufacturer — and more recently American manufacturers — produces a standard



unit that incorporates a magnetic clutch and a flywheel. To provide completely uninterrupted service with only a 3 to 6 percent drop in frequency, the normal power supply is used to power a motor which normally drives a generator supplying a. c. power to the load. In the event of power failure, the heavy flywheel, which also is driven by the electric motor, stores sufficient energy so that when the magnetic clutch engages it with the engine, it



When even the shortest power interruption cannot be tolerated, the use of an electric motor and inertia flywheel can provide continuous power with only a small frequency drop when the engine generator set is cut in. In normal operation, power flows to the motor which drives the generator which in turn furnishes power to the load. When the normal power fails, the flywheel is engaged with the engine shaft and provides the cranking power to start it. Meanwhile, the generator continues to be driven by the flywheel until the engine can take over the load. Only a 4 to 6 percent frequency drop occurs as the engine is started.



When a short break of around 0.2 seconds can be tolerated, the load can be handled by the normal power supply. At the same time, normal power is used to drive a small motor which in turn drives an inertia flywheel. When there is a power failure, the load is switched to the generator which is clutch connected to the flywheel. At the same time, the flywheel engages the engine shaft and starts it so that continuous power is provided to the generator. The engine can pick up generator load in a minimum of 1.2 seconds.

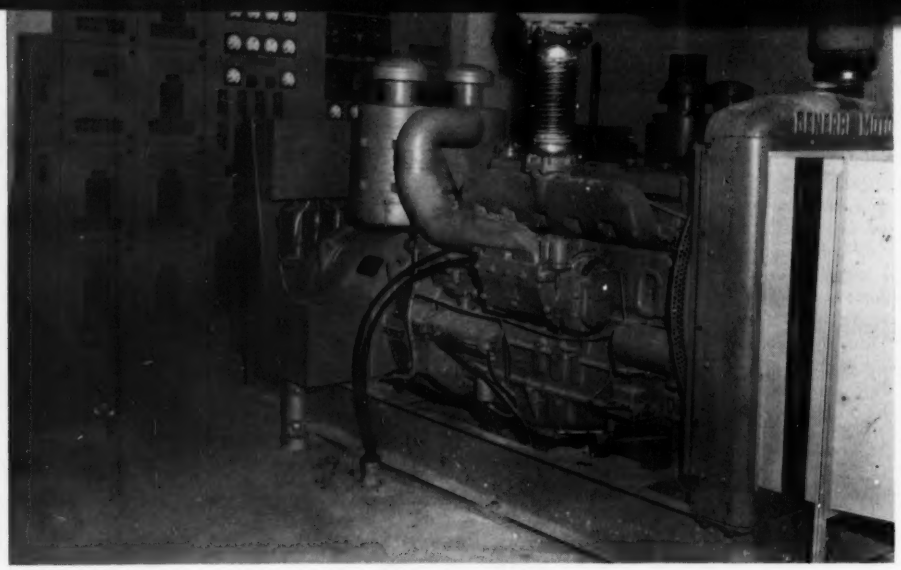
starts it quickly. Meanwhile, the momentum of the flywheel continues to drive the generator, and only a momentary frequency drop results as the changeover is made.

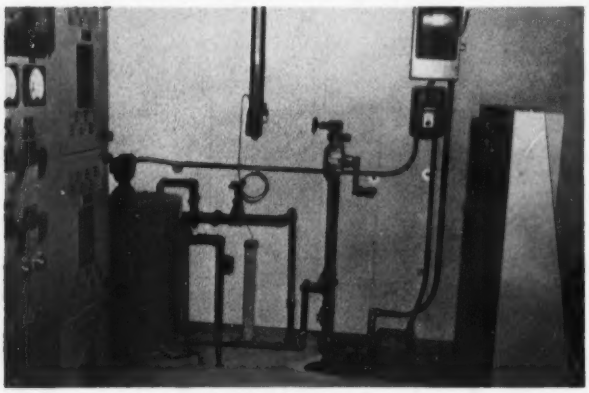
Where a break of about 0.2 second can be tolerated, the utility power source normally can supply the load directly, the flywheel being driven by its own electric motor. On power failure, the magnetic clutch is engaged so that the flywheel drives the generator (to which the load is switched) and the flywheel also starts the engine. Similar units can be operated with a hand clutch if an attendant is normally on duty, and a motor-generator unit can be substituted for the separate motor and generator, simplifying the installation.

Speed of power transfer also is affected by the engine and its fuel. Although cost factors are usually against the steam engine or steam turbine, they may prove economical under certain situations. However, they are slower than batteries or internal combustion engines in getting on the line, so they are almost automatically excluded where starting time is important.

Fuel Systems

Much has been said about the comparative starting merits of gasoline and diesel engines. However, there is good reason to believe that with proper accessories there is little difference in their starting ability. Because of gasoline's volatility, the





Twin diesel generator sets were specified by Ralph E. Phillips, Inc. for the Los Angeles County Hall of Administration. The two generators are connected through automatic synchronizing equipment into a switchboard which feeds both lighting and power. They are connected in such a manner that if one generator fails to function, the circuit breakers feeding the power loads do not close and only lighting loads are picked up by the remaining generator. Note details of fuel system which appear in the lower photograph.

gasoline engine needs the protection of a day tank to insure the presence of fuel when the engine is needed. By the same token, special diesel fuels and engine heater elements may be needed if diesel engines are to start quickly at lower temperatures. Diesel engines are normally difficult to start below 40 F if no special provisions have been made, and there are some consulting engineers who report difficulty even in the 50 F range.

Other fuels for engines may offer advantages in certain areas. For example, natural gas offers instant availability for starting, requires no storage facilities, and burns cleaner with fewer objectionable exhaust gases. Similarly, liquid petroleum gas may offer advantages, although it requires special storage facilities. Except under unusual conditions, the type of fuel has little influence on the speed with which an engine will start, assuming it is properly equipped and maintained.

There are many other factors in equipment selection of importance, but these are primarily economic. In normal situations, the package unit as provided by many manufacturers is ideal, and consulting engineers need only specify the proper package and provide for proper emergency circuitry in the distribution system and proper installation. In other situations, where unusual power conditions must be satisfied, there is a great need for specially designed systems. Then, the consulting engineer must assume a much greater degree of technical responsibility and certainly a heavier design load. The selection of other than standard switch-gear for a package unit is in itself an exacting task.

The reliability of any emergency source is dependent entirely upon the maintenance that it receives. The finest piece of generating equipment manufactured will not be available when an emergency occurs if it is not maintained properly and operated on a regular test schedule. Therefore, after a job is completed, it is the consulting engineer's responsibility to impress on the client or the maintenance engineer the importance of keeping the equipment in first class operating condition at all times. The Commonwealth of Pennsylvania has covered this by requiring all public buildings to maintain records of all equipment tests.

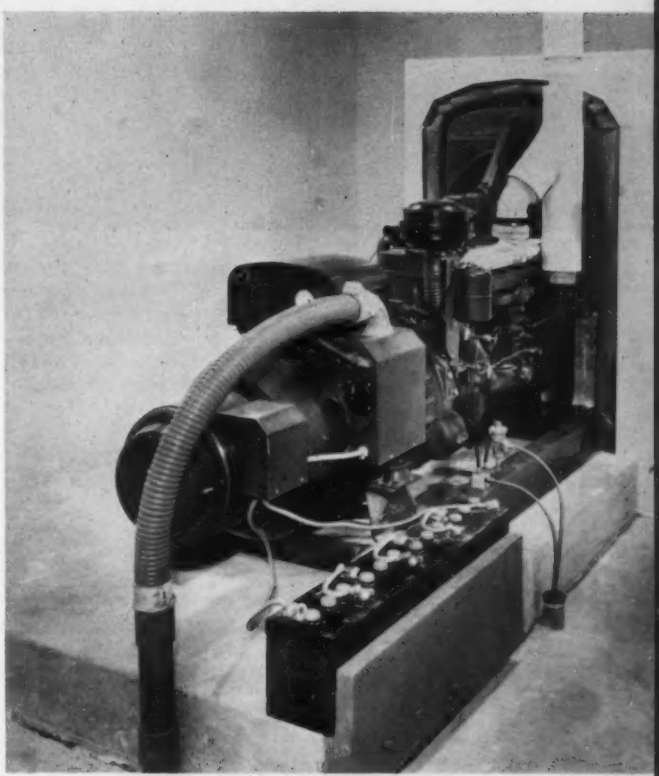
Standby Power And Emergency Lighting

Planned Installation

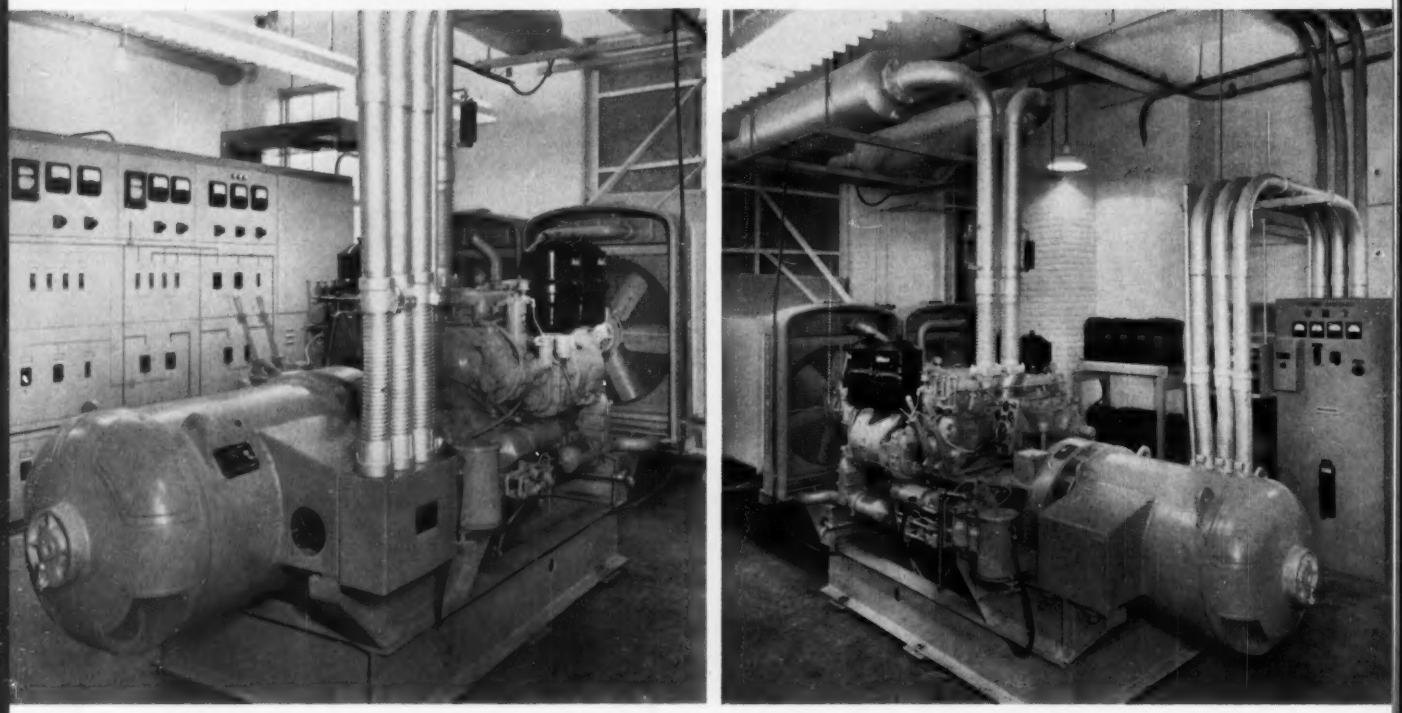
After establishing the need, making the engineering study to determine how much and what type, and finally selecting the actual equipment, the consulting engineer must further plan for the actual installation of the standby equipment. He must make structural provision for mounting the machinery and the fuel storage tank, if needed. The structural problem may be a significant one, particularly if the client, as he so often does, finally agrees that standby power is needed only after building construction is well under way – or even completed.

Engine generator units can be mounted on specially designed concrete foundation pads, but alignment problems may cause trouble. However, if the pads are located on grade, there is a distinct advantage in the elimination of vibration problems both from the structural design approach and from the acoustical problem of noise elimination. When smaller size package sets are specified, they usually are shipped on their own rigid steel subbase. Larger units are similarly mounted but may have to be disassembled for shipping. Anchor bolts must be located for this type of base, and even if the units are placed over heavy floors and beams, installation of vibration isolators is advisable. These are available in a wide variety of types from both standby power equipment manufacturers and other sources. Gasoline supply tanks usually are relegated to underground storage by code restrictions, but diesel fuel tanks can be placed in the building, and in larger sizes they will require structural consideration.

Under proper conditions of climate, equipment might be located outside, protected only by a sheet metal enclosure. A 300-kw unit will occupy a space of only 8 feet by 16 feet, but the location of switchboard and controls is usually the determining factor in establishing inside space allotment. Location of the equipment must take into consideration proper exhaust venting and the cooling system



The Laurel Pipe Line Co. of Camp Hill, Pa., pumps refined petroleum products from the Atlantic Seaboard to Cleveland, Ohio, and intermediate points. Automatic pumping stations and delivery installations are all controlled by micro wave from the central office. Gatter and Diehl specified this 75 kw, 120/208 volt, 3 phase, 4 wire Kohler emergency gasoline powered generator system to provide an uninterrupted source of power. The automatic start unit has a 5 minute time delay relay in the stop circuit to prevent the emergency generator from dropping off line for short current restoration periods.



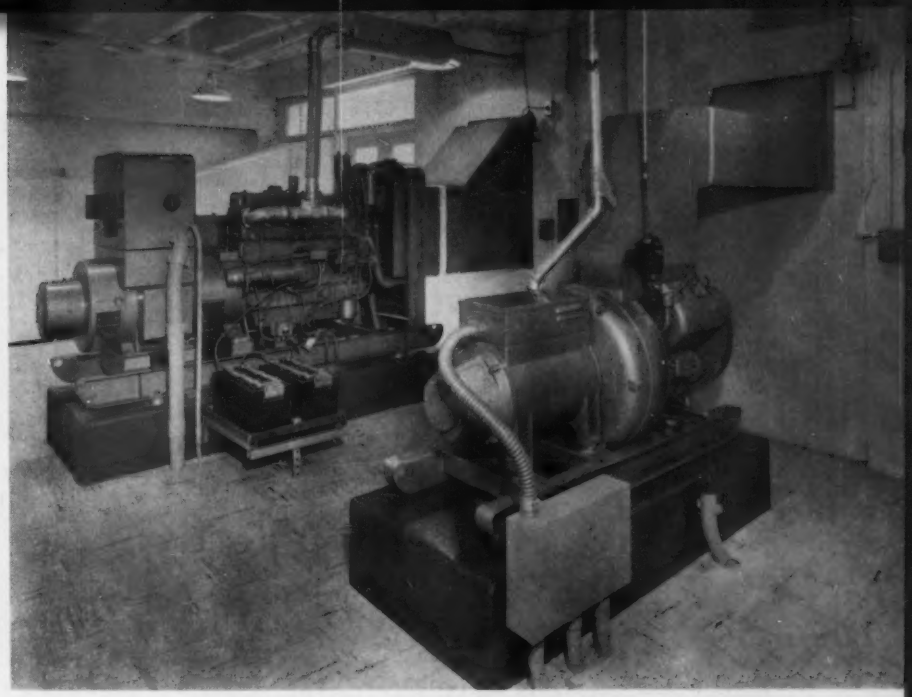
Twin diesel engines drive the emergency generator located on the third floor of the Williamsport Exchange and Office of Bell Telephone. Special structural design was required by Gatter and Diehl to accommodate the weight of this unit. Fresh air is supplied through the roof and exhaust air is ducted from radiators direct to outside. Fans and louvers in fresh air supply duct go into operation when generator is started, as do motor operated dampers in exhaust duct. Fuel tank is located about 150 feet from building, and high lift requires electrically operated fuel pump as well as a manual hand pump for use if the fuel pump should fail.

tie-in. Thus, a location on the building perimeter is generally desirable.

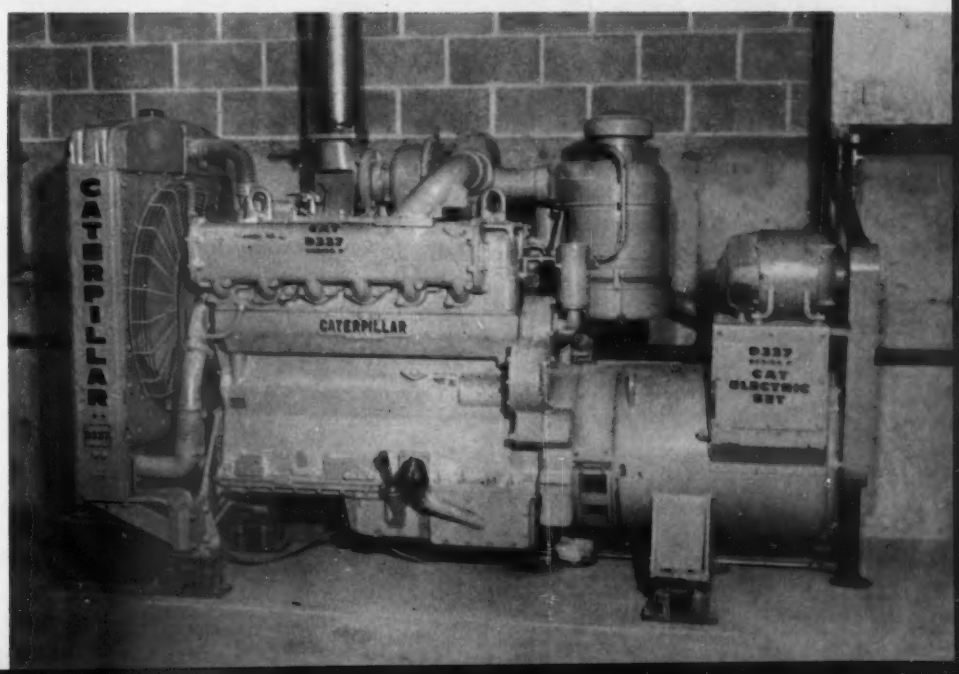
Exhaust systems may be the inside, outside, or waste heat recovery types. It is seldom desirable to allow exhaust fumes to escape inside the building, but catalytic exhaust systems are available to remove noxious or irritating fumes. With outside exhaust lines, special care must be taken to avoid fire hazards and insure complete discharge of fumes. The addition of a silencer and the use of flexible tubing for sound and vibration deadening and allowance for thermal expansion is advisable. Where steam is required and electrically produced, as in many hospitals, the provision of an exhaust heat boiler may be desirable. On larger engine generator units a good supply of low pressure steam can be produced to meet emergency needs.

Radiator cooling is most commonly used because it is least expensive, but special equipment is available for insuring adequate air flow, and louvered openings must be provided in the standby power space. Heat exchanger cooling and tempering tank systems are also practical, and eliminate the need for rapid air circulation. The heat exchanger will require extensive plumbing work and usually a pump. The tempering tank system is adaptable where the regular water line can be tapped as a source of supply, with excess water leaving the system through an overflow.

Battery standby units also have their problems. The lead-acid battery can produce corrosive and combustible gases and hence must be located in an area with good air circulation and away from any open sparks or flames. This is not true of nickel-cadmium or nickel-iron-alkaline batteries. Large numbers of battery units in a high voltage system will introduce rather heavy loading, but it is static and hence easily analyzed. In addition, since they produce no noise or vibration, battery systems may be located almost anywhere in the building. Thus, their location is dictated by the desire to minimize wiring and still maintain easy access for servicing.

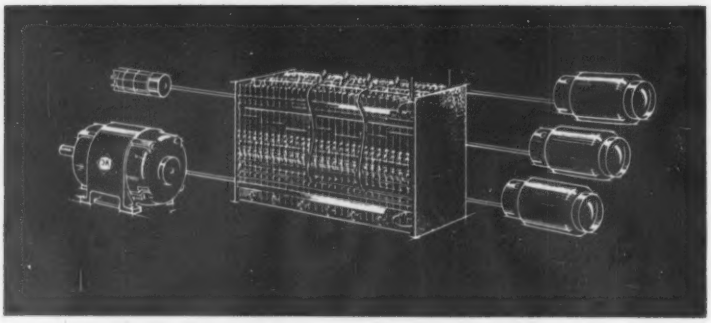


Carlisle Business Office and Exchange of United Telephone Company has two gasoline engine generator sets specified by Gatter and Diehl. Larger unit provides 50 kw – 120/208 volt, 3 phase, 4 wire. Supplied by U. S. Motors, it has built in exciter, voltage regulator, low water and oil alarm, cranking limit switch, and ammeters and volt meters for reading voltage and current across all phases. Smaller unit is 10 kw micro wave generator operated by 208 volt, 3 phase motor normally, with gasoline engine for emergency.



Peoria's Proctor Community Hospital has 137 beds, and will accommodate 220. Emergency diesel generating system powers 2 elevators, all air conditioning, surgical and delivery suites, refrigeration for food and baby formulas, plus all emergency lighting. Generator also has capacity for additional elevator to be added in future expansion program.

Standby Power And Emergency Lighting



Fuel cells may offer future source of power for emergency systems if current development programs pay off.

Future Considerations

New York's historic power failure of September 1959 produced no major catastrophe. It did make clear the fact that major power failures can occur. And it raised the question of whether or not our huge cities can demand a constantly increasing power load from antiquated distribution systems. The cost of an adequate solution is fantastically high, and there is good reason to believe that it is economically unfeasible for private power companies to undertake the task. Until this distribution problem can be solved, there probably will be increasing need for standby systems in our large cities.

Consulting engineers frequently find themselves wrapped in a ribbon of red tape. On one recent Federal building project the consultant found that restrictions covering "emergency lighting" were actually hindering him from developing an adequate and effective system. The legal intent was excellent, but its execution was preventing sound design. The problem finally was solved by the use of new terminology. Instead of "normal" and "emergency" lighting it became "essential" and "nonessential." From this experience, it is evident that consultants have an important stake in future legislation.

Unfortunately, nuclear power stations appear to be no more reliable than conventional sources of electric power. In fact, engineers at Gibbs & Hill have discovered that both large and small nuclear stations require substantial sources of standby power. A requirement of 200 to 400 kw is not uncommon. Moreover, these standby facilities must take over loads in less than one minute.

This quick takeover requirement is imposed by the need for continuous removal of residual heat from the reactor core and the maintenance of operation of essential instrumentation. Continuous power service also is required for cleanup systems such as those used for the demineralization of coolants in nuclear power plants of the light-water type design.

When the nuclear station is part of a larger system, there is normally an ample supply of power available for startup and shutdown conditions. However, in remote areas, engine generator facilities are required both for startup of the plant and for standby. Since startup demands are rather large, these standby systems must be selected to meet this initial load, even though later standby requirements may be much lower.

No one cares to predict the future of solar conversion units or fuel cells in the field of standby, or even normal, power supply. Current efforts in the fuel cell field are directed to powering farm tractors and fork trucks, and one company is developing a small portable unit to supply power for military communications. There are also extensive research programs under way at several large battery manufacturers' laboratories. The fuel cell may well be a primary source of power in the not too distant future if its theoretical ability to provide nearly 100 percent efficiency from fuels is approached. Meanwhile, silicon cell blocks have been used in solar conversion units which are capable of charging batteries.

What is needed now is a standby system for cloudy days; a lunar conversion unit for moonlit nights – and a direct conversion nuclear generator in every garage. ▲▲

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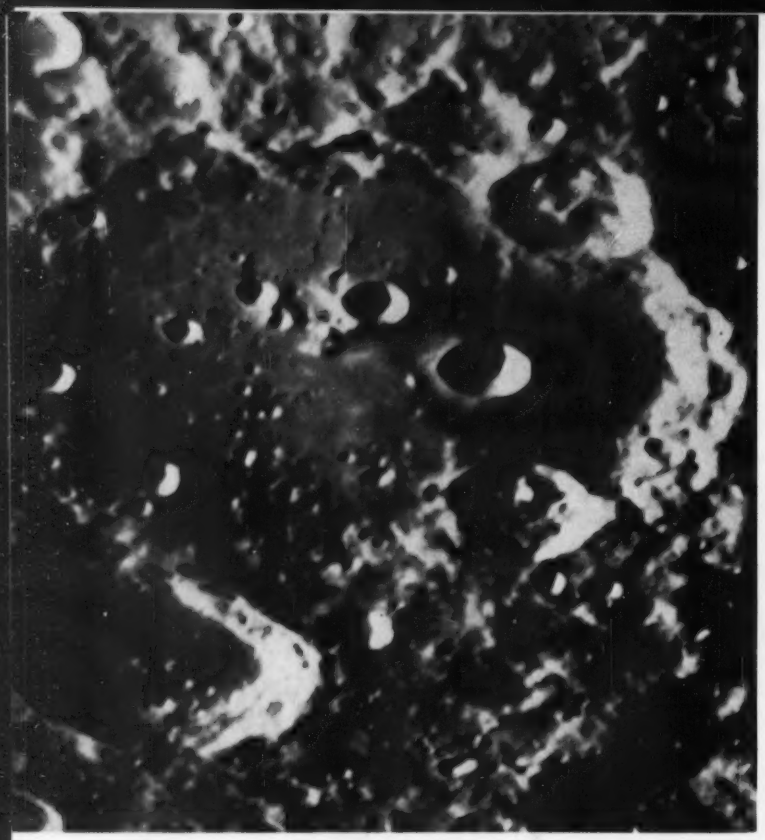

Mapping the Moon

DONALD R. LUEDER, President
Geotechnics and Resources, Inc.

The moon in the region of Clavius. Scale is about 1 inch to 20 miles.

THE MOON has fascinated man for milleniums.

CE exclusive

But until the last decade, lunar science has not been notable for either volume or dependability of data. To some degree, this paucity has resulted from the necessity for long distance conjecture. To a larger degree, it has resulted from lack of interest.

Distant galaxies, spiral nebulae, and the boundaries of the Universe have proved more fascinating than the relatively prosaic characteristics of our only natural satellite. The construction of the huge light-gathering telescopes, such as Palomar, combined with a conviction that the moon's essential aspects were known, have aided this preoccupation with the more remote areas of the heavens.

Impact of the Space Age

The advent of the Space Age, with its compelling political implications, has changed this attitude. The moon now has become the earth's frontier, and if man is to develop it, he must first study it. In the pioneer tradition, he must begin his advance in this direction from as firm a foundation of knowledge as it is possible to obtain.

This is easy to say, but hard to do. Not much of real value is known about the moon. There is a wealth of theory, strenuously championed, but nevertheless, contradictory, extrapolative, and speculative. Not even the true nature of its surface — topographically or geologically — is more than generally agreed upon.

Certainly, there is not enough knowledge to either select a target area or design a rocket for landing. Will the target area be rough or smooth, rocky or covered with dust? No one knows.

Perhaps because it sought the answers to some of these questions, the National Aeronautics and Space Administration called on Geotechnics and Resources, Inc. to begin preliminary studies aimed at determining the feasibility of using photogrammetry and photographic interpretation to map the lunar surface. At any rate, the task was begun in June of 1959. Only one major restriction was placed on the project. It was limited to earthbound photography, with shots from satellites and rocket probes considered to be completely out-of-bounds. The establishment of feasibility criteria was a major task, and some of the salient features proved to be of considerable interest.

Photogrammetric Study

The basis of all photogrammetric mapping, whether on earth, moon, or Mars, is the achievement of proper stereoscopy. Stereoscopy has been defined as that total phenomenon enabling a receptor-integrator combination, upon receiving two different

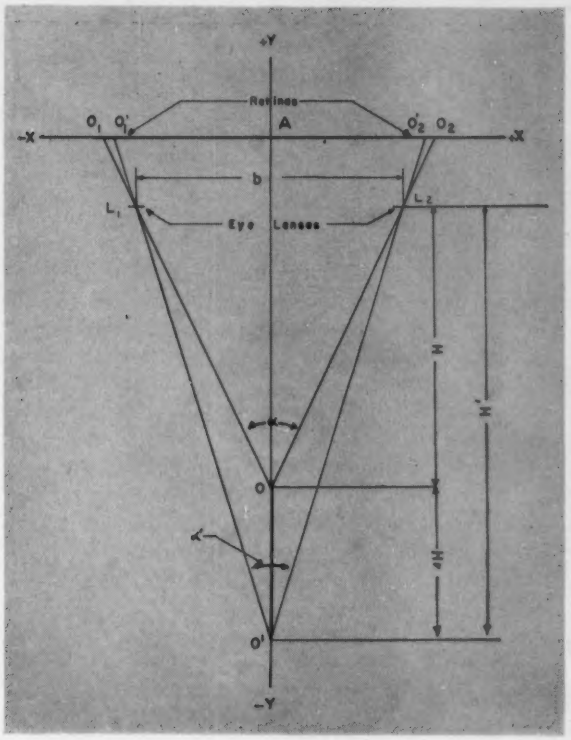

Fig. 1 – Shown here is the basic geometry required for stereoscopy. Two eye lens-retina combinations, separated by an interpupillary distance b, view an object O-O' of height Δ H from vertical distances of H (top of object) and H' (bottom of object). The angles α and α' included by the ray-paths from the two receptor-systems to the top and bottom of the object respectively, are called by various names, angle of parallax and angle of convergence being most common in photogrammetry. If a coordinate system is erected through 0-0', with an abscissa in the "plane" of the retinas, and an origin at A, by convention distances from A to the right will be positive and those to the left negative. The absolute stereoscopic parallax, p, for any point may be defined as the algebraic difference of its abscissas along the above axis, i.e., $P_0 = (+AO_2) - (-AO_1) = AO_2 + AO_1$. It is evident from the diagram that α is not equal to α', and that Po is not equal to Po'. It is evident that α and p for any point will change as b, H, and Δ H change. This fact allows photogrammetric mapping of elevations since a geometrical relationship may be established between Δ H and the change in parallax, Δ p, of two points.

views of an object, to synthesize them into a three-dimensional model of the object.

Normal human visual experience is based upon the stereoscopy associated with the eye-brain combination. This phenomenon is called stereoscopic vision and allows perception of depth. It exemplifies stereoscopy in general, including that of the photogrammetric variety, and its geometrical depiction, as shown in Fig. 1, may be considered basic. Fig. 1 indicates that measurement of change in parallax is the essential element of photogrammetric analysis, and it is toward accurate determination of this change that lunar photography must be aimed. In such photography the eye-receptor system is replaced by the camera-receptor system, the camera lenses replacing the eye-lenses, and emulsions replacing the retinas.

Fig. 1 also indicates the essential elements that are required for a practical lunar (or, in fact, any other) photogrammetric system:

¶ A defined, or definable, theoretical metrical relationship, depicted in terms of optical ray-paths, between an object and a receptor-system.

¶ A means of satisfying the theoretical geometric relationship, using actual ray-paths, and an actual receptor system.

¶ A means of stereo-synthesizing the perspective images received and recorded by the receptor-system, into a three-dimensional model that can be measured and translated into maps.

The conventional way to analyze the moon photogrammetrically would be to photograph it simultaneously from two different stations separated by a distance equal or close to the earth's diameter. Such a procedure would yield parallax and allow stereoscopy. However, an angle of convergence of only 0.033 radians would be involved, and poor depth-perception would result.

Librations

Accuracy of point determination improves when the distance between camera stations is increased relative to observational distance. Professor Irish has combined the use of this fact with the exploitation of lunar librations, to achieve a much more favorable analytical situation.

Librations (which have been aptly termed "nodding" of the moon) refer to periodic slow vibrations of the moon toward and away from the earth. There are several types of librations that need not be considered here. The important thing is that they allow stereoscopic pictures of the moon to be taken from the same point on earth. The geometrical situation appears in Fig. 2, with Fig. 2c acceptable as the theoretical earth-moon relationship for effective photogrammetric mapping of the lunar surface. It

will be noticed that effective stereoscopy is dependent upon a time lapse.

The engineering, mechanical, geodetic, and economic advantages of single station photography will be apparent to most civil engineers. The photogrammetric advantages are even greater, for by proper use of the librational effect, a photogrammetric base-height ratio of only 1:3.6 can be obtained. This is better than the base-height ratio used in much photogrammetric engineering work on earth.

Librational and Atmospheric Effects

The factual existence of a satisfactory earth-moon relationship does not insure its achievement. Many factors inhibit exact solution. These include regular variations in the magnitudes of regular quantities (or the factors which determine them); irregular variations in such quantities and factors; and insufficient accuracy in establishing them.

Because of such variations and inaccuracies, the actual metrical earth-moon relationship may be visualized as one resembling the theoretical one in every important respect. However, there is a continual shifting of the b, d, and Θ characteristics (Fig. 2) within a narrow range, and also things are slightly out of focus. This is particularly true, since a composite view of two separate views taken at different times is involved.

Librations, although they are regular variations which allow the photogrammetric solution of Fig. 2, have not been computed with an accuracy that would be desirable in studies of the lunar surface. The existent accuracy is good enough for the production of usable and comparatively detailed photogrammetric maps, but greater accuracies are needed.

Irregular variations having a highly adverse effect upon photogrammetric accuracies, are those distortions of the optical ray-paths that are related to atmospheric effects. These effects usually are lumped together under the term "atmospheric refraction," although they may include components that are not refractive in the strict sense of the word. The most important components are probably those which occur in the lower atmospheric layers as mass refraction, air tremor, and turbulent or velocity refraction.

Such phenomena may have a complex effect upon the actual ray-paths of the lunar photogrammetric

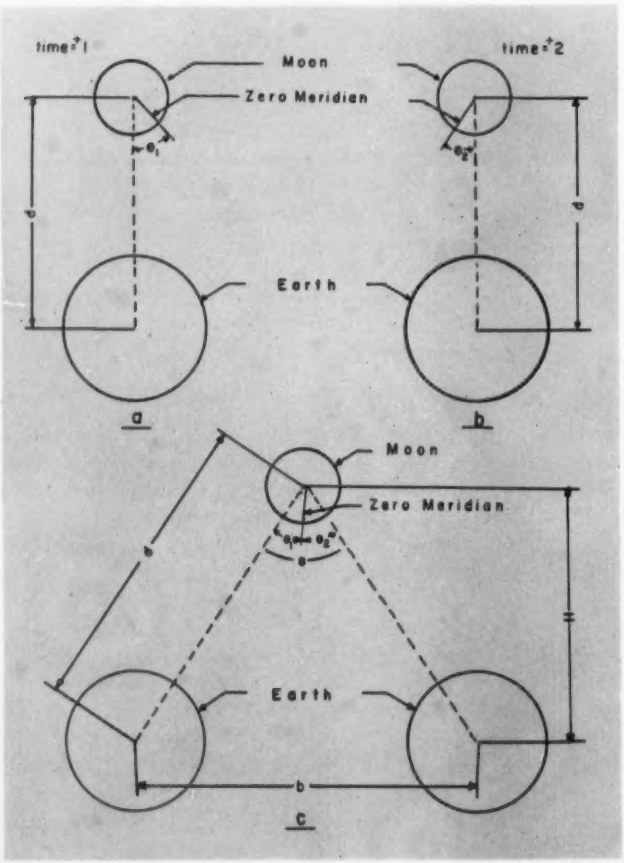

Fig. 2 — One possible metrical solution to the lunar photogrammetric problem. At time t (Figure 2a), the Earth's selenographic longitude is Θ_1, while at time t_2 (Figure 2b), it is Θ_2, the Moon having librated meanwhile through a clockwise angle of $\Theta_1 + \Theta_2 = \Theta$. The net effect is shown in Figure 2c. In this, assuming $\Theta_1 = \Theta_2 = \Theta/2$, then $b/2 = d \sin \Theta/2$. For $\Theta/2 = 8°00'$ (which is a reasonable librational value), and $d = 240{,}000$ miles, $b = 66{,}800$ miles; $H = 238{,}000$ miles; and the ratio of base to height is 1:3.6, a most satisfactory value for analytical use.

problem, primarily because the two halves of the stereoscopic pair will be taken some time apart, when atmospheric "refractive" effects might be greatly different. In this respect, lunar photogrammetry is at a disadvantage when compared with terrestrial aerial mapping, wherein successive photographs are taken almost simultaneously, and through essentially similar atmospheric complexes.

The magnitudes and variations of earth's atmospheric effects, in terms of their distortional effects upon ray-paths, are almost completely unknown, and require specific investigation for each member of a lunar stereopair. There are a number of ways for effectively minimizing the effects of atmospheric distortion of ray paths, particularly if high-level platforms are used. They never can be eliminated completely, however.

Lack of adequate resolving power in the lens-film combination always has been advanced as a major deterrent to effective lunar photographic study. Geotechnics and Resources does not believe the deterrent effect to be nearly so serious as has been commonly assumed. However, one of the major difficulties has been the development of equations covering plotting errors.

Photographic Interpretive Study

The preliminary study of photographic interpretation, as a means of studying lunar terrain, has been centered around the basic requirement of satisfying four general criteria:

¶ Adequacy of the photographic interpretive technique (nature and requirements; body of theory and practice; needed qualifications of personnel; proven capabilities)

¶ Adequacy of lunar environmental knowledge (existing state; extension of existing state by logical geoscience)

¶ Adequacy of stereoscopic and monoscopic photographs (multiple selectivity; functional stereo-definition as a criterion of photographic suitability; scales; stereo-geometry, viewers, and cameras)

¶ Adequacy of time-economics

Even in its preliminary stage, the study of photographic interpretive feasibility has proved more complex than that of photogrammetry. The reasons have been related to the necessity for dealing with qualitative concepts, rather than neat quantitative equations; and also to the extremely nebulous and contradictory state that characterizes existing knowledge of the lunar environment.

Photographic interpretation has been evaluated from the standpoints of its theoretical competence, degree of sophistication, and proven capabilities. In doing this, it has been necessary to distinguish it from other techniques with which it is often confused, such as photogrammetry and photo-analysis.

The distinction has led to a definition of interpretation as a "new natural science of remote terrain study, concerned with the stereoscopic, inductive, and deductive evaluation of natural terrain elements, in terms of the interpretor's education, experience, and body of interpretive theory, as a means of determining the composition and structure of the terrain."

It has been concluded that photographic interpretation can produce dependable information on rock-types, land forms, soils-textures, drainage conditions, depths of soil, buried structure, and a variety of other land characteristics that will have value to practical operations on the moon, as well as the design of vehicles and structures for use on its surface.

Integrated, Dynamic Morphology

While studying the adequacy of basic, lunar, environmental knowledge (from which successful photographic interpretation must proceed), it was found that the interpretive technique itself had much to offer the very nebulous state that exists. Among its possible contributions is a concept which professional photo interpreters often use – usually unconsciously – in conducting earthbound terrain studies. To the best of the writer's knowledge, this concept has not been named or promulgated in any formal fashion before. It may be called (somewhat pedantically, but nevertheless accurately) the principle of integrated, dynamic, crustal morphology.

Most natural and physical phenomena involving many factors or forces, are indeterminate in the sense of unique solution. While the effect of given factors can be studied (all others held constant), the combined effect of all factors cannot be predicted easily – except in broad empirical or experimental terms.

The civil engineering profession is well acquainted with such situations in terms of hydrology, hydraulics, river and harbor studies, and soils problems. The geologic formation of landscape is a prime natural phenomenon that is usually similarly indeterminate, and therefore must be approached in a sound and orderly manner.

Inter-Action of Processes

The sound and orderly manner, in turn, must proceed from the concept of integrated, dynamic, crustal morphology. This says that all crustal terrain forms, structures, and compositions, wherever they occur, result from the continuous and complexly integrated inter-action of various basic and secondary natural processes, whose relative dominance is related to existent environments. To phrase it another way, natural processes operate in a complex, closed system of inter-action that is always in motion, but that can be analyzed in terms of how, why,

and when, by studying the past results of the system under similar environmental controls.

Appreciation and use of this concept is fundamental to successful, remote, terrain analysis of the moon. Otherwise, there is a compelling tendency to extrapolate the results of telescopic and spectoscopic measurements far beyond their probable true significance. To prevent this, an integrated crustal land form chart was developed specifically for use in this study.

Multiple Selectivity in Lunar Photography

Obviously, the success of photographic interpretation of the moon's surface, depends in no small measure upon the suitability of the photographs that can be made available for interpretive study. Regardless of the criteria for suitability, photography of the moon can make great use of opportunities for multiple selection.

Photography, even under laboratory conditions, involves an astounding magnitude of combinations of resolution, contrast, sharpness, exposure, processing techniques, emulsion types, and photochemical reactions. For lunar photography, this magnitude becomes infinite due to considerations of object characteristics and "seeing" conditions, combined with a wide range of camera possibilities.

In terms of lunar photography, this situation is a favorable one. As in the integrated analysis of dynamic morphology, a logical organization of general families of photographic causes or factors can be set up to show general families of photographic results. These can be used to plan effective lunar film exposures. Contrary to the analysis of integrated crustal landform, which results from natural processes and cannot be humanly controlled, photography is a technological process, and can be controlled.

Similarity in the orderly arrangement of probable causes and effects, combined with ability to control some or all of them, leads to multiple selectivity, i.e., numerous combinations of technological methods and factors that can be used to achieve a desired practical result. Multiple selectivity should be used in actual procurement of lunar photographs and must be used in estimating the feasibility of same.

Problem of Resolving Power

One of the long-time basic problems associated with lunar photography has been the presumed lack of adequate resolving power in photographs, for detailed study of the lunar surface. The concept of resolving power originated in astronomy, and referred to the ability of an observer, using a given telescopic system, to visually separate, against a black background, objects such as paired stars, whose centers subtended very small angles at the telescopic lens.

Certain theoretical and empirical physical equations can be shown to yield resolving powers of 2500 to 5000 feet on the moon's surface, when long exposures and vibratory effects of the earth's atmospheric blanket are considered. Such powers would be largely useless, by themselves, for lunar photointerpretation, because the terrain would be represented by a fabric of points spaced at intervals of 0.5 to 1.0 mile apart, and intervening detail would be lost.

Fortunately, there is reason to suspect that the theoretical and empirical equations are ultra-conservative. In addition, for interpretive purposes, exposures can be cut sharply, with a consequent alleviation of the atmospheric vibrational problem. As a result of these factors, it is believed that resolution can be reduced to something in the order of 500 feet, a ten times reduction.

Of even greater significance is the contention that resolution is an imperfect and partial criterion to use in judging or predicting the subjective technical quality of photographic detail for photointerpretive purposes. A number of other factors enter the picture, and with exceedingly important effects.

Functional Stereo-Definition

A new term for the subjective technical quality of lunar photographs could well be functional stereo-definition, (FSD), and refers to the true ability of the human eye to perceive significant detail, for some practical purpose, when viewing photographs stereoscopically.

This ability is exceptionally complex and cannot be explained in detail within the limits of a brief discussion. In general, however, it is a function of the following primary variables:

¶ Definition in the photographic emulsion (in turn, dependent upon resolving power, sharpness, graininess, and tonal reproduction)
¶ Stereo-synthesis of form
¶ Psycho-perceptive abilities of the interpreter
¶ Nature of object being studied
¶ Conditions of viewing during photography

It should be noted that resolution has only a partial effect on FSD. The significance of FSD as a criterion of detail rendering ability is great, particularly when combined with opportunities for multiple selectivity. It makes it reasonable to predict that much more valuable lunar photography can be obtained than has previously been thought possible. In this regard, as in all photographic interpretation, stereoscopy is essential. It is interesting to note that no stereoscopic views of the moon of any importance are yet available. ▲▲

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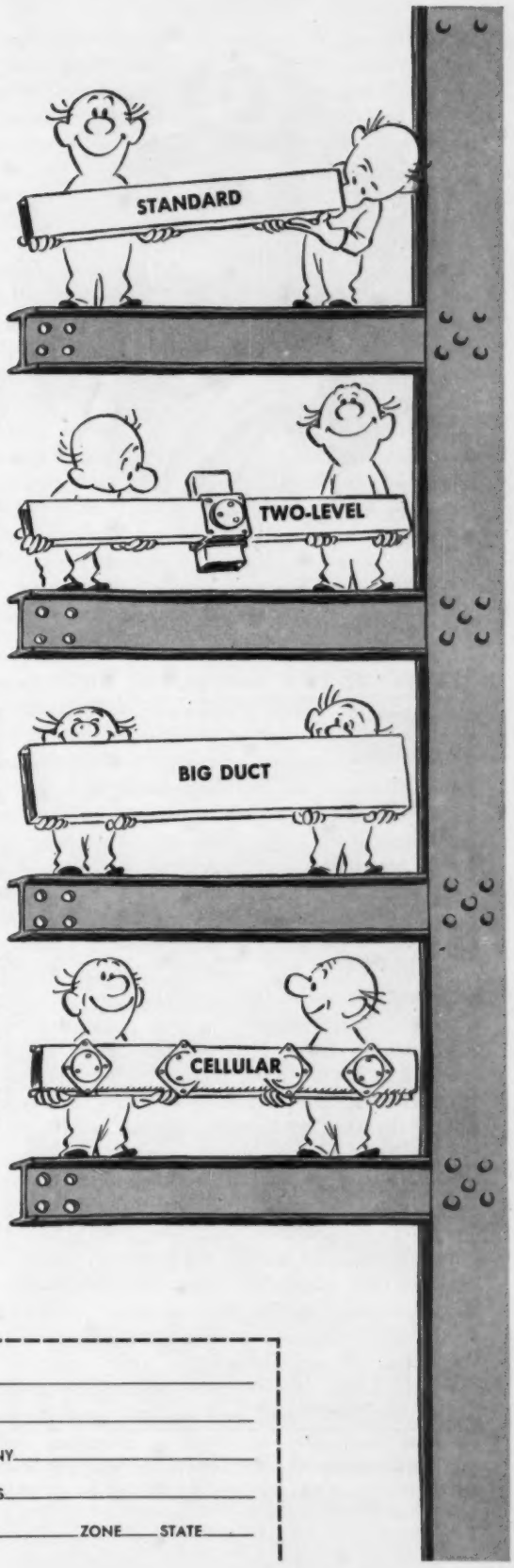

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Georgius Agricola

Agricola's De Re Metallica

JAMES KIP FINCH, Dean Emeritus
Renwick Professor of Civil Engineering
Columbia University

ALTHOUGH THE METALLIC ARTS have played a major role in determining the course of human history, it remained for a German physician and public official of the late Renaissance to bring together the discoveries and techniques of this ancient, but long neglected, art. In his book *De Re Metallica,* Georgius Agricola gave form and body to the metallic arts and provided a text that remained the standard work on metallurgy and mining until the publication of Schluter's famous work, in 1738. In fact, much of Agricola's writing withstood the test of time until the coming of machine tools and dynamite.

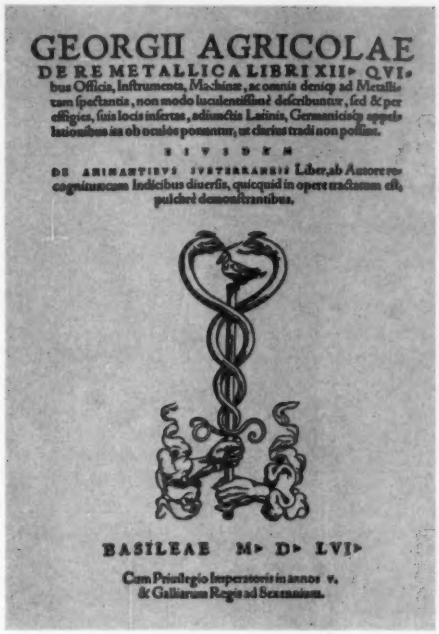
CE exclusive

Written in Latin, it is unfortunate that Agricola's work has never been translated properly into his native German tongue. Fortunately, however, one of the most outstanding translations was that performed by Ex-President Hoover and his wife. It was completed in 1912 and published in London by *The Mining Magazine.* In 1950 it was republished by Dover Publications, Inc., New York, ($10.00) complete with the almost 300 woodcuts from the original 1556 edition in Latin. For the Hoovers, this translation was "a labor of love," dedicated to the preservation of an important milestone in the history of engineering.

Georg Bauer was born in Blauchau, Saxony, March 24, 1494. Later he Latinized his name to Agricola and, after an excellent education and graduation from the University of Leipzig with an A. B. degree, taught school in Zwickau. In 1524 he went to Italy for further study in medicine and natural philosophy. Returning three years later he was chosen town physician of Joachimsthaal, in Bohemia, a small town then in the heart of the most active mining district in Central Europe. Later, he became city physician of Chemnitz, where he served as a burgher and occupied other elective positions until his death on November 21, 1555.

Agricola was clearly not a mining engineer by profession. He was, however, a learned man, the friend of Erasmus and other intellectual leaders of his day. He was also a technical man, a physician, with a basic interest in and gift for factual observation and reporting. "Those things," he holds, "which we see with our eyes and understand by means of our senses are more clearly to be demonstrated than if learned by means of reasoning." *De Re Metallica* was the result of over 20 years of study during which Agricola visited mines and smelters, read the few scattered references from earlier Greek and Latin authors, and conversed and associated with the most learned of the mining men. His life centered in a mining community, and mining captured his interest. He owned shares in the God's Gift Mine at Albertham, "since," as he said, "the very times when the mine began first to bestow its riches."

Agricola was not, as the Hoovers point out, "at all times free from error and the spirit of his times . . . His statements are sometimes much confused, but their clarity is as crystal to mud in comparison with those of his predecessors and some


GEORGII AGRICOLAE

DE RE METALLICA LIBRI XII. QVI-

bus Officia, Instrumenta, Machinæ, ac omnia denique ad Metallicam spectantia, non modo luculentissimè describuntur, sed & per effigies, suis locis insertas, adiunctis Latinis, Germanicisq; appellationibus ita ob oculos ponuntur, ut clarius tradi non possint.

EIVSDEM

DE ANIMANTIBVS SUBTERRANEIS Liber, ab Autore recognitus cum Indicibus diuersis, quicquid in opere tractatum est, pulchrè demonstrantibus.

BASILEAE M. D. LVI.

Cum Priuilegio Imperatoris in annos v. & Galliarum Regis ad Sexennium.

voted to a spirited defense of the metallic arts. "Many persons hold the opinion," he says, "that the metal industries are fortuitous and that the occupation is one of sordid toil, and altogether a kind of business requiring not so much skill as labor. But as for myself, when I reflect carefully upon its special points one by one, it appears to be far otherwise. For a miner must have the greatest skill in his work, that he may know first of all what mountain or hill, what valley or plain, can be prospected most profitably, or what he should leave alone; moreover, he must understand the veins, stringers and seams in the rocks. Then he must be thoroughly familiar with the many and varied species of earths, juices, gems, stones, marbles, rocks, metals, and compounds. He must also have a complete knowledge of the method of making all underground works. Lastly, there are the various systems of assaying substances and of preparing them for smelting; and here again there are many altogether diverse methods."

In Book II Agricola discusses the qualifications essential to the successful miner, and to profitable

of his followers." He soundly condemns the alchemists who seek to deceive people into believing that they can change "the substance of base metals." They should be "held in the greatest odium," he insists, "for their frauds are a capital offense." Yet, he apparently accepted the earlier and current legends of the various animals and gnomes which the miner might encounter underground.

The Mining Profession

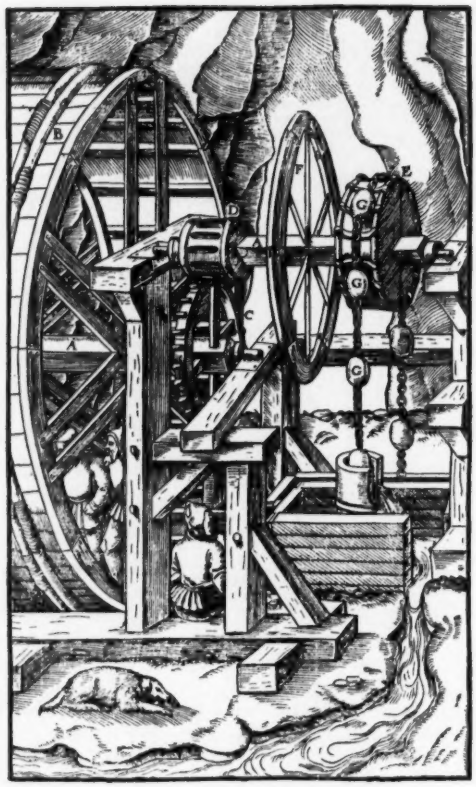
Of the 12 books into which *De Re Metallica* is divided, the later chapters, dealing with mining and metallurgical operations, techniques, and equipment, usually receive major attention. Actually, however, the first four chapters, on mining in general, on prospecting, and on mining laws and organization, are equally interesting to the modern mining engineer.

In dedicating his work to the Electors of Saxony, Maurice and Augustus, his patrons, Agricola says, "The subject of mining is a very extensive one, and one very difficult to explain; no part of it is fully dealt with by the Greek and Latin authors whose works survive; and since the art is one of the most ancient, the most necessary, and the most profitable to mankind, I consider that I ought not to neglect it. . . . This book itself indicates the length and breadth of the subject, and the number and importance of the sciences of which at least some little knowledge is necessary to miners."

Apparently Agricola felt compelled to explain his interest in mining, for his first "book" is de-

Shaft sinking and drifting operations made use of hand hoists or windlasses and crude four wheeled carts for removing both waste material and ore.

Principle of similar triangles was commonly used to obtain the depth of shaft and length of tunnel meeting it.



Walking wheel chain pump drew balls through wooden pipe to remove water from working face of the mine.

Carefully presorted ore bearing rock was crushed by a water wheel powered stamp mill before final sorting.

mining. His shrewd observations on mining investments apply equally well to modern operations. "When anyone, in an endeavour to increase his fortune, meets the expenditure of a mine alone, it is of great importance that he should attend to his works and personally superintend everything that he has ordered to be done . . . When one man alone meets the expense for a long time of a whole mine, if fortune bestows on him a vein abundant in metals he becomes very wealthy; if, on the contrary, the mine is poor and barren, in time he will loose everything which he has expended in it. If he is ignorant of the art of mining, then it is advisable that he should share in common with others the expenses, not of one only, but of several mines."

It has been remarked that the Romans and other earlier peoples had probably left few exposed and obvious mineral deposits for future workers to exploit. Any search for deeper, hidden ores involved greater risks and increased expenditures for exploration and development, and resulted in the pooling of interests and capital which mining shares made possible. In fact, this means for both meet-

Typical furnaces described by Agricola, with one smelter tapping a melt and the other carrying charcoal.

Agricola's interests also included the art of glassmaking as a result of his stay in Venice on a journey to Italy.

ing expenses and sharing risks appears to have been well developed and widely used even in Roman mines.

The Hoovers observe that, "Of all of Agricola's theoretical views those are of greatest interest which relate to the origin of ore deposits." Agricola uses the Latin *vena*, or veins, not only for fissure veins but "to designate," as he says, "any mineral substances [i.e., ores] which the earth keeps hidden within her own deep receptacles." He notes that ore veins have been created subsequent to the rocks containing them, and, while erroneously assuming that the vein channels were created solely through erosion by underground waters, his ideas that they were filled by deposition from circulating solutions was a notable contribution to the modern understanding of ore deposits.

In searching for veins Agricola notes that the divining rod was used by some miners but makes his own view of this device clear. "A good and serious miner should not make use of an enchanted twig . . . because there are natural indications which he can see for himself without the use of twigs." Thus, recalling his erosion theory of veins, he advises prospectors to "observe the bubbling waters of springs, which cannot be very far distant from the veins because the source of water is from them . . . also examine the fragments of veins which the torrents break off from the earth . . ." He adds that one should also "observe the hoarfrosts, which whiten all herbage except that over the veins . . . and note whether the trees lose their verdure or become black or discolored due to the hot and dry exhalations of the veins."

As with all older authors, veins are overemphasized by Agricola. All ore deposits are regarded as of vein origin and are thus *vena profunda, dilatata,* or *cumulata.* Book III, with 30 woodcuts, is devoted to descriptions of various forms of branching and other veins — "the various and manifold varieties of veins and stringers." It includes a discussion of the use of the magnetic compass to determine the direction of a vein.

In Book IV, which deals with mining claims and the officials who had charge of mining affairs, the organization and management of share companies is described in detail. "It is complained that some sellers and buyers of the shares in mines are fraudu-

lent. I concede it," says Agricola, "but the wise and prudent man . . . goes at once to the mine that he may for himself examine the vein."

Agricola also tells us how "the miner, if the vein he has uncovered is to his liking, first of all goes to the Bergmeister to request to be granted a right to mine, this official's special function and office being to adjudicate in respect of the miners. To the first man who has discovered the vein the Bergmeister awards the head meer [i.e., claim] and to the others the remaining meers, in the order in which each makes his application. Since mines vary in shape, according to the different varieties of veins it is necessary for one," he notes, "to go into detail concerning them [the claims] and their measurements . . . Of the width of the meer, one half lies on the footwall side of the vein and one half on the hanging wall side. If the vein descends vertically into the earth, the boundaries similarly descend vertically; but if the vein inclines, the boundaries likewise will be inclined. The owner always holds the mining right for the width of the meer, however far the vein descends into the depth of the earth." Thus, "the apex law" was recognized.

The Hoovers, in an extended footnote on the history of ownership and mining law regard this as "the logical development of the conception that the minerals were of quite distinct ownership from the land."

Mine Surveying and Mining Methods

"When a miner discovers a *vena profunda,*" Agricola says, in Book V, "he begins sinking a shaft and above it sets up a windlass, and builds a shed over the shaft to prevent the rain from falling, less the men who turn the windlass be numbed by the cold or troubled by the rain . . . It is advantageous if a shaft connects with a tunnel [i.e., driven in from a lower level to connect with the bottom of the shaft] for then the miners and other workmen carry on more easily . . . but if the shaft is not so deep, it is usual to drift from one or both sides of it. From these openings the owner or foreman becomes acquainted with the veins and stringers that unite with the principal vein, or cut across it." Various suggestions regarding indications of ore in connection with this exploration follow.

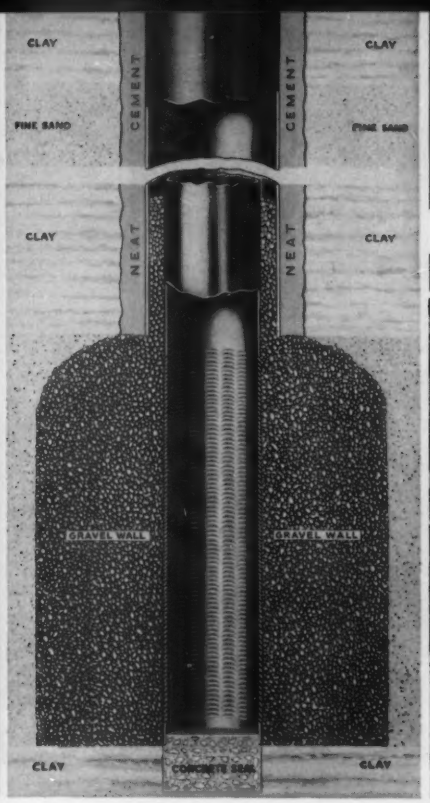
"The mode of working," says Agricola, "is varied and complex, for in some places they dig crumbling ore, in others hard ore, in others a harder ore, and in others the hardest kind of ore . . . Miners dig out crumbling ore with the pick alone . . . With regard to the harder veins which are tractable to iron tools . . . they generally attack them with more powerful iron tools . . . As for the hardest kind of metal bearing vein, which in a measure resists iron tools," Agricola observes, "if the owners of the neighboring mines give them permission, they break it with fires." It was almost a hundred years later, in 1627, that gunpowder was first introduced in mining and it apparently did not reach Britain for another 75 years. Thus, the ancient method of fire-setting, as described by Agricola, was long used and is said to have still been employed in some German and Norwegian mines down to the end of the 19th century.

Turning to surveying Agricola notes that, "Each method of surveying depends on the measuring of triangles. A small triangle should be laid out, and from it calculations must be made regarding a larger one. Most particular care must be taken that we do not deviate at all from correct measuring; for if, at the beginning, we are drawn by carelessness into a slight error, this at the end will produce great errors." Thus, he illustrates the problem of digging a tunnel from a lower level to intersect a shaft, pointing out that the proportions of the smaller triangle measured at the mouth of the shaft give the depth of shaft and length of tunnel if the inclined distance, shaft-mouth to tunnel entrance, is measured. "The measuring cords used," he says, "are made of linden bark because they do not stretch at all." When other problems arise, such as joining an existing and not straight tunnel to a shaft he describes the use of cords with waxed circles to record the changes in direction required in a survey of the tunnel.

Tools and Machines

Book VI is devoted to the tools and machines used in mining and is, to the general reader, perhaps the most interesting chapter in Agricola's text. In addition to wheelbarrows, trucks, and other hauling devices, Agricola records that additional machines fall into three groups — hoisting machines, pumps, and ventilating devices. While smaller windlass hoists are turned by men, larger hoists driven by a horse also are described. Such hoists are used not only to raise dry materials, but also buckets of water. A water wheel 36 feet in diameter operating a hoist is described by Agricola as "the largest machine of all those which draw water." Nevertheless, numerous pumps are illustrated including not only piston pumps but endless chain types with buckets and also the "ball and chain" form with cloth balls on an endless chain raising the water in a pipe. These are driven by a man-operated tread mill as well as by water wheels.

In connection with mine ventilation Agricola observes that, "If a shaft is very deep and no tunnel reaches it, or no drift from another shaft connects with it, or when a tunnel is of great length . . . then the air does not replenish itself. In such a case it weighs heavily on the miners, causing them to



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breathe with difficulty, and sometimes they are even suffocated, and burning lamps are also extinguished." Three types of ventilating devices are noted, including various deflecting forms to direct the wind downward into a shaft, fans rotated by hand, and, finally, bellows.

Assaying

In this history of mining and metallurgy, Books VII and VIII, dealing with assaying and ore dressings, undoubtedly stand out as the most notable contributions to technical procedures. Agricola was the first to describe the advantages and the methods of assaying ores. "By tests of this kind," he notes, "miners can determine with certainty whether ores contain any metal in them or not . . . whether it is much or little . . . the best method by which the metal can be separated from that part of the ore devoid of it." He shrewdly adds, "By smelting a small quantity they learn whether the smelting of a large quantity will compensate them for their expenditure."

The Hoovers note in their translation that although many men undoubtedly had added to the development of assaying, Agricola was the first to produce a systematic text containing much that was entirely new as well as numerous details omitted from earlier works. Here appear most of the reagents and most of the critical operations for the dry analysis of gold, silver, lead, copper, tin, quicksilver, and iron. Also included are many of the "tricks" of the art still in use today. Assay furnaces, muffles, crucibles, and cupels are described; detailed instructions for the various tests are given; and the use of the touchstone, together with a set of 12 standard test pieces or needles of various mixtures of gold and silver, is explained. "When a bar of mixed metal is rubbed on the touchstone and colors it just as the needle does," says Agricola, "it contains the same proportion of gold the needle does."

Ore Dressing

Book VIII is not only the longest in this remarkable treatise, but includes no less than 65 woodcuts devoted to illustrating the preparation of ores for smelting. Agricola first emphasizes the importance of keeping the loosened ore separate from the country rock. But, as he notes, "Although the miners, in the shafts and tunnels, have sorted over the material which they mine, still the ore which has been broken down and carried out must be broken into pieces by a hammer or minutely crushed, so that the more valuable and better parts can be distinguished from the inferior and worthless portions." Thus, as a first step in concentrating ores, "sorters" are shown working with hand hammers sorting "the more precious from the worthless." Later, stamp mills and stone mills driven by water wheels are illustrated and described in detail.

Smelting

"Although those who burn, roast, and calcine the ore," Agricola continues, "take from it something which is mixed or combined with the metals; and those who crush it with stamps take away much; and those who wash, screen, and sort it take away still more; yet they cannot remove all which conceals the metal from the eye and renders it crude and unformed. Wherefore smelting is necessary for by this means earths, solidified juices, and stones are separated from the metals so that they obtain their proper color and become pure, and may be of great use to mankind in many ways." Various smelting furnaces are illustrated and described.

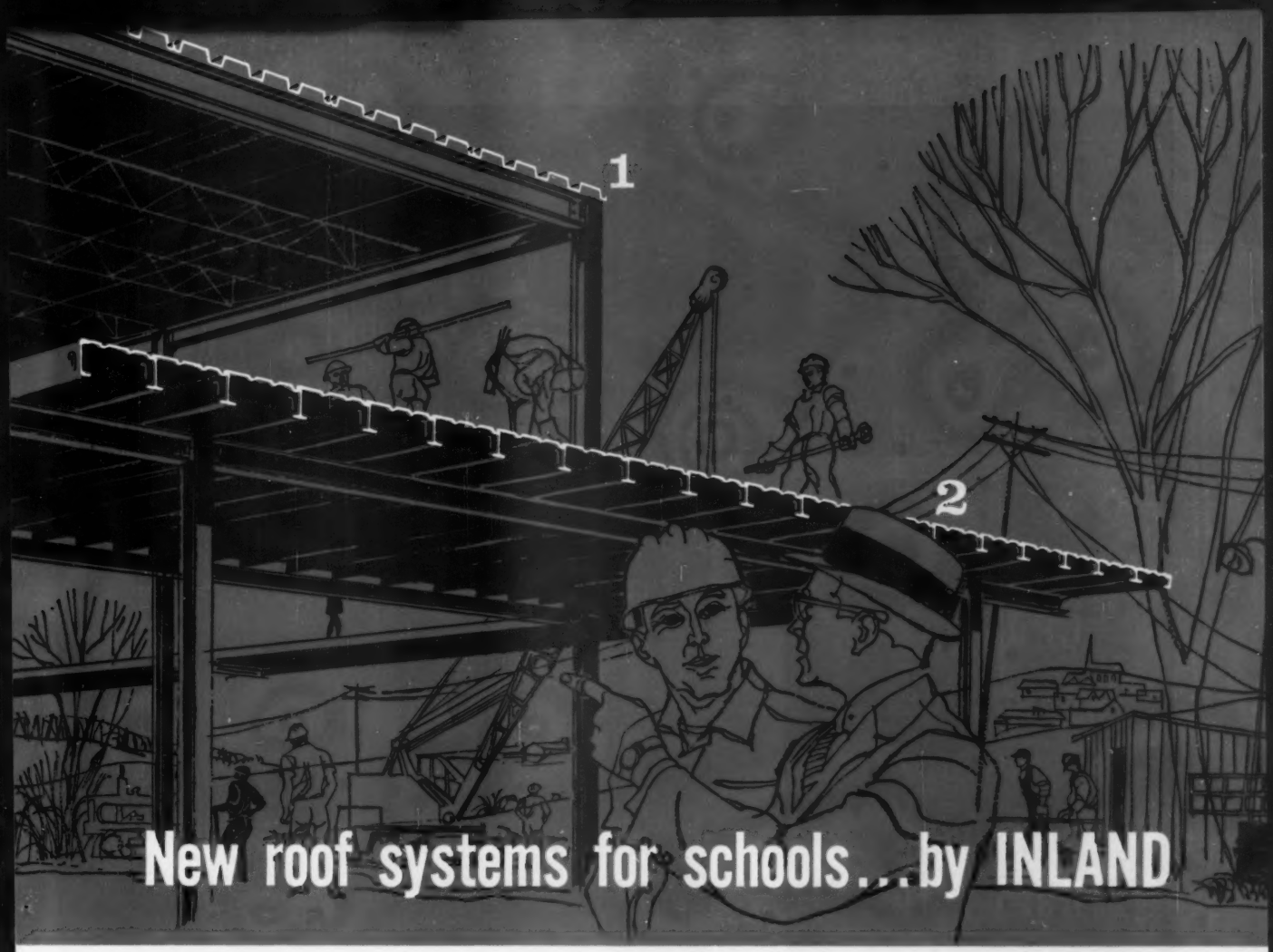
In discussing iron, Agricola appears to follow the earlier work of Biringuccio. In addition to the early method of producing a pasty mass of malleable iron directly from the ore in a forge fired with charcoal and lime, the Germain *stuckofen*, or high furnace, with a greater blast, added the possibility of first producing cast iron and then refining this to produce wrought iron. Cast iron had thus come into use, but it is not clear that the refining process was understood, and it was not effectively applied until the end of the 18th century.

Agricola was especially interested in the recovery and separation of gold and silver. "Frequently two metals, occasionally more than two, are melted out of one ore, because in nature generally there is some amount of gold in silver and in copper, and some silver in gold, copper, lead, and iron." He therefore devotes Book X to the recovery of gold and Book XI to that of silver.

Finally, in his last book, Agricola turns to what now would be considered problems of chemical engineering. He admits these matters "might be considered as alien to things metallic;" nevertheless he defends their inclusion on the ground that, like the metals, such chemicals as salt and soda, sulphur and bitumen, are natural products derived from the "solidified juices" of the earth.

Glassmaking in particular seems to have captured his interest, for he notes, "The glassmakers make diverse things, such as goblets . . . flasks . . . panes, which wonderful works I have seen when I spent two whole years in Venice some time ago."

De Re Metallica is one of the great books of the ages, the result of Agricola's interest in "a most ancient and necessary art" which persuaded him that "he should not neglect it." *De Re Metallica* ranks Agricola with his contemporary, Galileo, as one of the first in a distinguished group of scholars who clarified the methods of modern science. ▲▲



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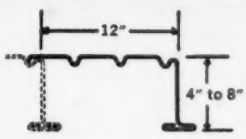

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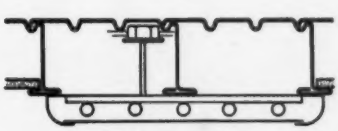

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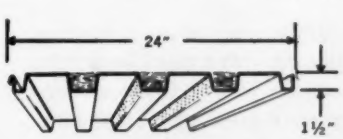

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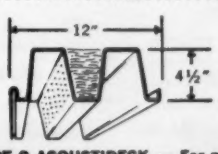

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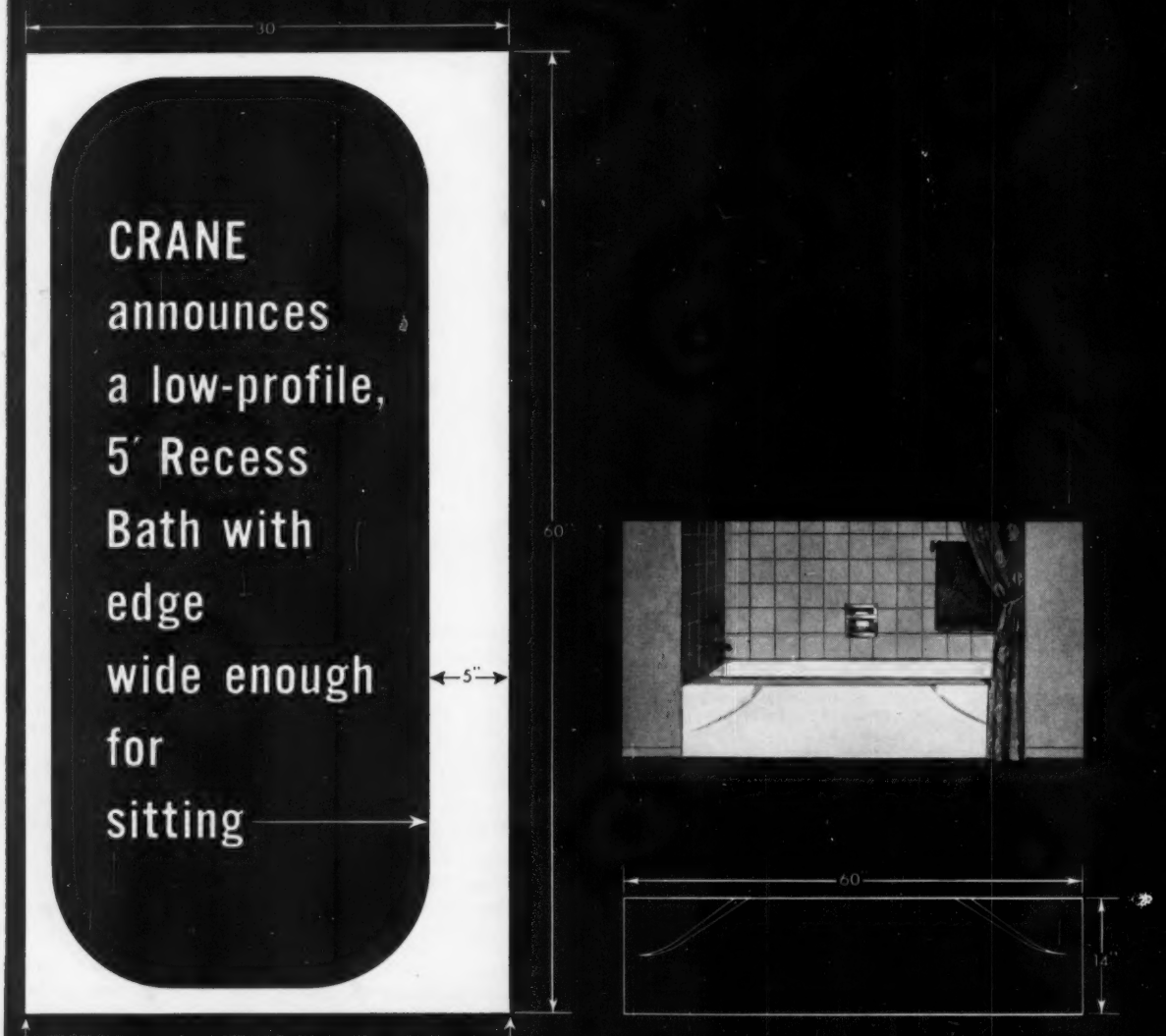

THE FAIRFAX Designed by Henry Dreyfuss

Crane quality—a Dreyfuss design—yet priced in the medium range. The floor to top height of the Fairfax is only 14", for easy entry and exit . . . a full two inches lower than most baths. Available in regular or acid-resisting porcelain enameled cast iron. Trim is exclusive Crane *Dial-ese*. You can specify the Fairfax in any of the full range of Crane colors and white.

The Crane Fairfax—Length: 5′; Width: 30"; Seating Edge Width: 5"; Height: 14"

New Crane *Star*Lite* Accessories and Fairfax Bath are available through your Crane Distributor who also has a complete line of Crane quality plumbing ware for every installation. Call him for full facts on these new Crane products.

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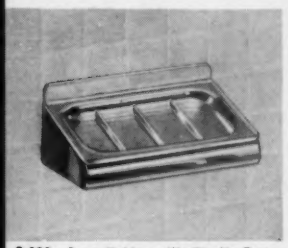
There's the booming population growth —a 34 million net gain, or a 16% increase.

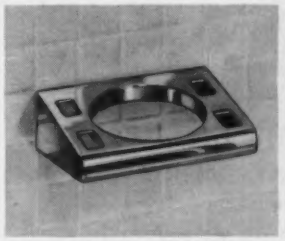
There will be more households. We need homes and schools and hospitals—and buildings of all kinds. We have to provide new construction for the newcomers... and also to replace those made obsolete.

Crane announces Direction '70... to help you meet the challenge of the Soaring Sixties. These are products to improve building quality. These are products to increase efficiency. These are products to help curb rising costs.

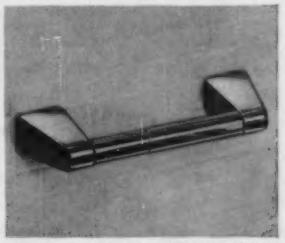
On these pages are the first of these new Crane developments... the first of many you'll be seeing in Crane's Direction '70.



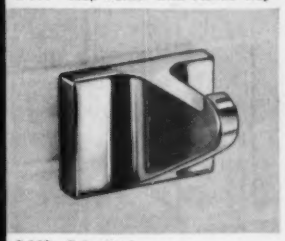
2-900 Soap Holder with Plastic Tray



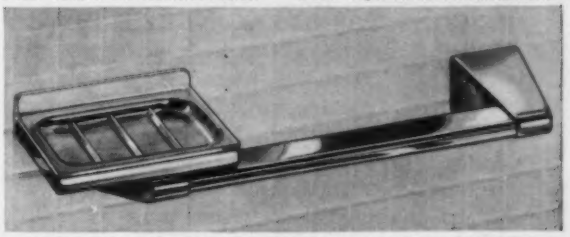
2-902 Tumbler and Toothbrush Holder



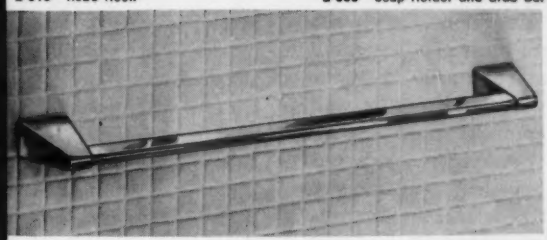
2-904 Paper Holder with Metal Roller



2-910 Robe Hook



2-906 Soap Holder and Grab Bar with oval-shaped Metal Bar and Plastic Tray

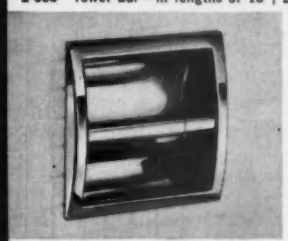


2-908 Towel Bar—in lengths of 18", 24" and 30"

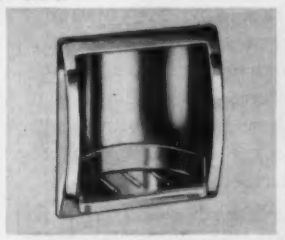
Cross-section of bar shows unique oval shape. This provides greater separation for faster drying. Gives unit a distinctive modern appearance.

RECESS ACCESSORIES

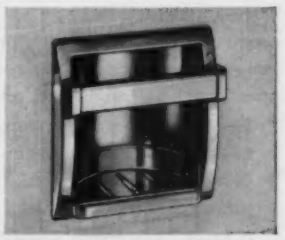
Overall Size: 6⅛" x 6⅛".
Wall Opening: 5¼" x 5¼" x 2¼".
Recess Accessories are regularly furnished for wood screw installation.



2-915 Paper Holder with Metal Roller



2-917 Soap Holder with Plastic Tray



2-919 Soap Holder and Grab Bar with Plastic Tray

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Getting Together Means Business

Small firms gather into groups to handle multimillion dollar projects

By THE ECONOMIST
INTELLIGENCE UNIT LTD.

THE CONSULTING ENGINEER in Western Europe often finds his biggest opportunities abroad, but it is also in the foreign field that he is most likely to miss opportunities. Development projects in Africa and Asia clearly offer immense possibilities for the consultant, but the attendant difficulties, risks, and uncertainties are on the same scale. Individual engineers in private practice, or even quite large independent firms of consultants, very often find that the barriers between them and successful operation in the foreign market are too great for their taste. When this happens the gap may well be filled by a contracting company supplying its own consultants — or by government-sponsored engineers. Yet the special challenge offered by large-scale work abroad has been met by consultants in several countries. A frequent and increasingly important answer is the joint-organization through which independent consultants combine to do work that they could not tackle singly.

There is, of course, nothing new in the idea of the joint venture in which several consulting engineers, each a specialist in his own field, work together as a team on a specified job. It is also well known for two or three firms to get in the habit of teaming up when required. But in several European countries more positive and permanent types of associations are being set up, often specifically for obtaining foreign projects, particularly in the underdeveloped countries.

Netherlands' "Nedeco" Well Established

The exact nature of the association and the degree of independence of the participants vary considerably from country to country. The largest and one of the best known is the Dutch "Nedeco" (Netherlands Engineering Consultants), founded in 1951. This, however, has the legal status of a foundation and does not, strictly speaking, have members. Nor is it primarily aimed at profit making. It exists to coordinate and promote Dutch consulting engineering abroad. It is governed by a board of directors and has a permanent staff of experienced engineers who deal with the preliminary work on each new project, call in the engineers needed, and coordinate their activities. In a sense all Dutch consultants are covered by the umbrella of Nedeco, yet none is certain of employment through it. Nedeco is careful not to compete with individuals or private offices: it will only undertake projects too large for a single firm. It never does work in Holland. It never brings in anyone connected in any way with contractors; and it never offers anything but consulting work. Its directors must be totally unconnected with any scheme that might in any way prejudice the professional advice Nedeco provides its clients.

Accusations Unfounded

Consulting engineers from other countries who have encountered competition from Nedeco sometimes accuse it of enjoying the unfair advantage of a state subsidy. This accusation has no truth. In spite of its national status, Nedeco is financially independent, and any profits it makes are taxed like those of an ordinary company. It does, however, have government connections in the rather formidable membership of its Advisory Board, which assists the directors. This board includes

representatives of the Ministries of Foreign Affairs, Economic Affairs, Public Works and Agriculture, and of the nationalized railways, mines, and Zuider Zee works, as well as the Royal Institute of Engineers and various Dutch universities. Nedeco sometimes does call in engineers in government employment as well as private practitioners, but when this happens the engineer gets unpaid leave from his government job and is paid by Nedeco. The foundation's declared object is "to pool the entire knowledge and experience of experts in Holland . . . including those in public functions."

Belgium Has One Group

There appears to be no organization in any other country comparable to Nedeco in status and scope, though there are a number of examples of smaller associations formed for work abroad, and several are completely independent of the state and of industry. In Belgium there is only one such group whose members are independent consulting engineers. This is CADIC *(Compagnie Africaine des Ingenieurs-Conseils)* which operates almost entirely in Belgian Africa. Thirty Belgian consultants form the company and hold equal shares in its capital of 3 million Belgian francs. All the members are experienced engineers with university qualifications and all belong to their professional association, the *Chambre des Ingenieurs-Conseils de Belgique.* CADIC has a small coordinating office in Brussels, but its main office is in Leopoldville, capital of the Congo, where it employs a sizable staff of engineers, draftsmen, and topographers, and runs a soil-mechanics laboratory. In this way the background work of any Congo project does not weigh on the home offices of the 30 CADIC members.

French Situation Is Complex

In France, where engineers are state-trained and very often state-employed, it is just as hard in the foreign field as it is at home to distinguish the private consultant, especially when he is part of a combine. About the surest test is membership in *Chambre des Ingenieurs-Conseils de France* which is restricted to independent consulting engineers connected in no way with sales, manufacturing, or contracting. The small consulting engineer firms in France seldom are concerned with foreign projects, but for the big firms there is, as in the case of Belgium, plenty of scope in African territories and even outside the French Union.

French Organizations

Until fairly recently the only organization that provided comprehensive advice on the engineering needs of the French underdeveloped territories was the state-run *Bureau Central d'Outremer.* The French government also controls, wholly or in part, a number of specialist engineering groups which exist entirely for working abroad. Mining, railways, electricity, and gas, for instance, are dealt with by SOFREMINE, SOFRERAIL, SOFRELAC, and SOFREGAZ — in some of which banks or industrial firms also own an interest. Three or four years ago, however, about 20 independent firms formed a group — ICO FRANCE — whose aim is to secure contracts in foreign markets. Once a contract is secured, ICO FRANCE acts as coordinator, the project being shared among as many of its members as necessary. It remains to be seen whether members of ICO FRANCE will compete successfully against government engineers in the overseas spheres where they are well established. But with the advent of self-government in Africa it seems likely that private enterprise will have greater opportunities.

There is at least one other group of this type. Its affiliated firms are all members of the *Chambre des Ingenieurs Conseils de France.* It is known as UTICI *(Union Techniques des Ingenieurs Conseils Independents de France),* and headquarters are in Paris. Seven small firms got together about three years ago to form this group primarily to be able to offer services equivalent to those offered by large and well known firms, such as Coyne-Belier, the dam specialists, who already do well abroad and do not need to be strengthened by permanent association with others.

German Organizations

Most engineers in Germany have not hitherto felt a strong need to do more than form the usual teams for foreign projects. But permanent associations do exist for work both at home and abroad, and are felt to be a valuable weapon not, as in France, against state enterprise but against the activities of the large contractors and manufacturers which tend to overflow into the consulting sphere. Many of the German associations are little more than the formal linking of two or three otherwise independent names who probably would have worked together unofficially anyway.

A society called the *Gemeinschaft Unabhangiger Beratender Ingenieurburos e. V* does exist to promote German consulting work overseas, but it apparently does not undertake any coordinating activities, having more the character of a professional association. Thirty-three consulting firms belong to this society, but they are entirely independent of each other, only occasionally forming temporary partnerships among themselves for specific projects.

A German organization rather closer to the ICO FRANCE or CADIC type is the *Deutsche Societat Beratender Ingenieure,* whose head office is in Cologne. Eight firms are linked in this organiza-

tion, and they work together at home and abroad. Their contracts usually are divided about equally between the two spheres. The group was not formed specifically for foreign projects; it merely happens to handle a larger number of these than other such groups in Germany, many of which operate to a large extent in the home market. In this respect Germany differs from the other countries. With but a few exceptions like the French UTICI, consultants prefer to act singly in the home market.

International Combines

A new and interesting group has just been formed on an international basis. It is one of the first of the Common Market engineering combines. Known as BECEG *(Bureau European de Controle et D'etudes Generales)*, it involves the joining of a German and a French firm. The German firm is Dr. Ing. P. Walter, of Essen, and the French is G. Bory, of Paris. The owners of each firm are members of the executive committee of FIDIC, the International Federation of Consulting Engineers, and their relationship in this international association work undoubtedly brought them into contact and suggested a joint firm for Common Market operations. This combination firm expects to add other firms to its stable and offer services not only inside the Common Market area but in the underdeveloped areas influenced by Common Market nations. It has offices in Essen and in Paris.

There also is the International Group of Consulting Engineers S. A., centered at The Hague. CADIC belongs to this. More international groups may follow if Common Market countries can agree on a standard of qualification.

Norway's Entry

Norway has had, for several years, a joint operation consisting of eight independent consulting firms brought together under the group title of Norconsultants, with offices in Oslo. This group engages only in work abroad, the individual independent firms, all members of *Radgivende Ingeniorers Forening* (The Society of Consulting Engineers), tending their own knitting inside Norway.

Britian and Italy Prefer Independent Action

No tendency to form permanent combinations of this type is as yet discernable in Britain or in Italy. British consultants prefer to retain the freedom to associate with whom they choose when they choose, though of course certain combinations frequently recur, sometimes on an international rather than a national basis — for instance the Coyne-Gibbs partnership on the Kariba dam. In Italy, still in its own southern areas an underdeveloped country, home projects keep most of the large engineering profession too busy to think much as yet of combinations for foreign ventures. The leading Italian engineers, such as Nervi and large firms like Techint, have certainly made their mark abroad, but as individual persons or firms, not as groups. Some of the younger engineers in Italy do, however, feel that the creation of permanent teams of specialists soon will become necessary.

Impetus Varies

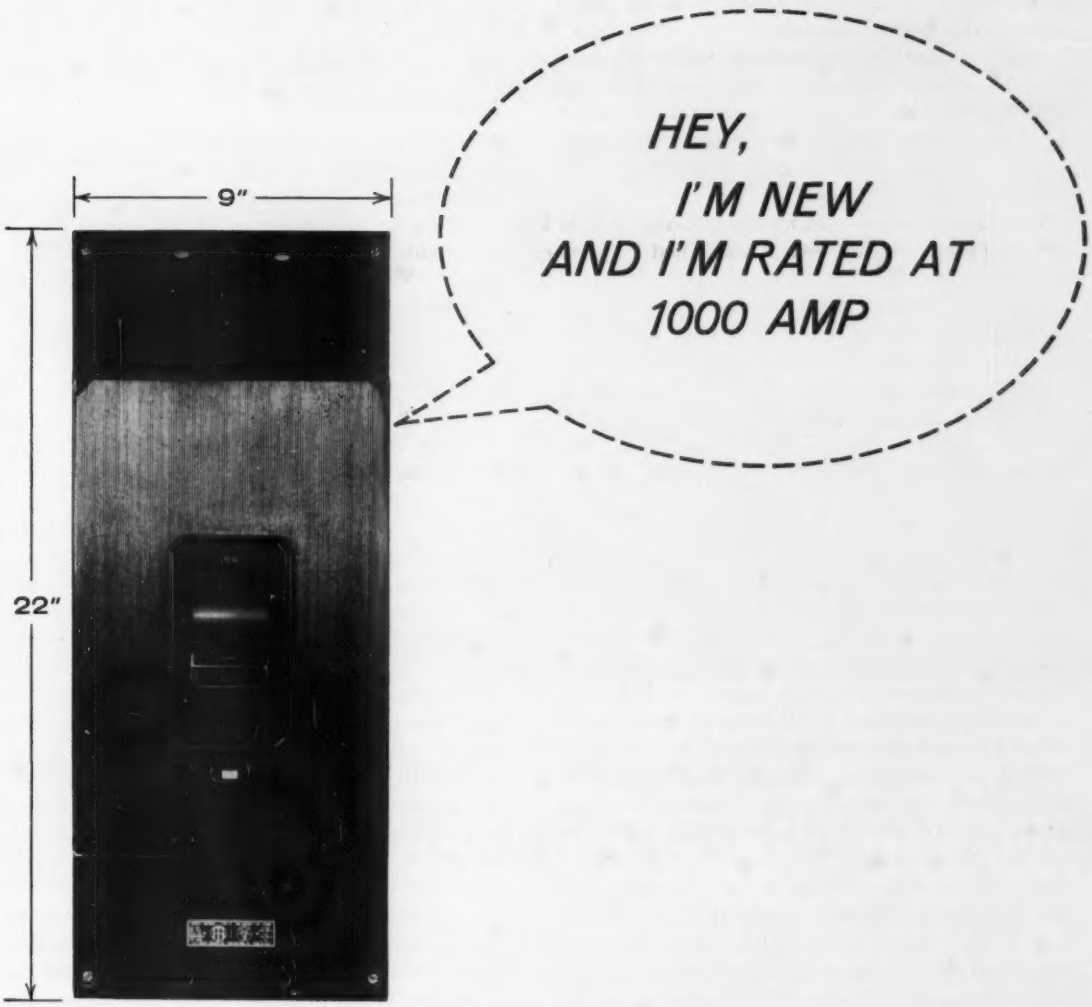
It is clear that the impetus that has led to the forming of engineer groups in certain countries varies according to circumstances. In Holland it has been a national effort, offering Dutch skill to the world and thus enabling the small Dutch profession to compete in a way it could not possibly have done disunited. It undoubtedly has succeeded in building up confidence, where previously the indefinite qualifications of many Dutch engineers may have undermined it. In Belgium and France the need was not so much to inspire confidence abroad as to meet the existing demands of dependent territories. In France in particular the main competitor of the private engineer is the government. In Germany the success of the big contractors and manufacturers has been a stimulus to formation of groups of independent consulting engineers.

Where the organization of the group is highly developed, a great load is lifted from the member offices. The sheer administrative difficulties and lack of personnel deter many individual firms from even attempting big jobs abroad, particularly in countries where distances are great and communications difficult. A coordinating office at home, as offered by Nedeco, can save the consultants concerned in each project an immense amount of trouble, time, and expense.

CADIC has carried the process even further, its well equipped office in Leopoldville often making it literally unnecessary for the various consultants to visit the site at all. Supervising of contractors and collecting of data is all done by the Leopoldville staff. Information is relayed to the appropriate office in Brussels, where each consultant works on his particular aspect of design. Other objections apart, CADIC admits that this system, though making for efficiency, does not cost the client any less than if the work was done by one firm. Everything hinges on the accuracy of the African office, which cannot be cheaply run, and moreover each consultant involved is paid as a principal.

Advantages

All these groups have certain common advantages. One is that they contain within themselves all the necessary types of specialists. Instead of the usual system whereby the civil engineer initially called



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in has to make separate arrangements with a series of electrical, mechanical, structural, or hydraulic engineers or other specialists in the increasing range of engineering expertise, a group like CADIC or ICO FRANCE already contains the talents demanded. The Nedeco system does mean picking a new team each time, but that organization is better equipped to do this than the ordinary civil engineer himself is, especially when it comes to obtaining experts of a very special kind. It is much easier for Nedeco, which can call on anyone from university professors onwards, to obtain the services of an expert when and where he is needed.

Another aspect of engineering undertakings in underdeveloped countries is the frequent uncertainty of the financial and economic background. A big, long-term job may for this reason be too much of a risk for an individual firm. A group is better able to face it.

From the client's point of view, a comprehensive group offering a wide range of services and unified planning often inspires more confidence than a single firm, however large. This is especially true of newly developing countries whose administrators may lack experience in obtaining engineering advice. As consulting engineers have discovered to their disadvantage, these countries often find it easier to accept a package deal offered by a contractor who undertakes to design as well as to construct the project.

Professional Practices

Countries like, say, Syria or Iraq, often expect a consulting engineer to submit a bid rather than charge a professional fee. All the groups mentioned prefer to abide by the normal professional standards in this respect and resist request for bids, but, as consulting engineers in all countries have found, where a foreign government demands bids by those offering professional services, the only thing to do is to submit one or withdraw. Feelings run high when one firm or group substantially undercuts another. British firms often complain that Nedeco does work at what appears to be impossibly low fees. Yet, Nedeco is not subsidized. It has to pay its way, so it cannot afford to take a loss. The only conclusion must be that an organization of this type can reduce costs considerably on a large project, provided it goes about it the right way. Fees and competitive bidding are, however, serious problems in international work, and the profession is still a long way from having internationally accepted minimum fee schedules or negotiation procedures.

In all the countries concerned, the groups adhere to the local practice for professional consultants with regard to publicity. Newspaper advertising by firms or individuals is frowned upon by all European associations of consulting engineers; a mention of a professional association in a technical journal is usually the furthest anyone goes. But across the narrow channel between publication display advertising and direct mail advertising, the groups undoubtedly have an advantage over individual firms. The mere name tells a prospective client that this is what he is looking for, and he probably will be supplied, on inquiry, with a well produced and perhaps expensive informative brochure. Sometimes a group can carry this a bit further; ICO FRANCE once sent out a glossy brochure to 5000 potential foreign clients, a scheme which on cost would be ruled out for most individual firms.

Results Satisfactory

It is less easy to demonstrate by specific examples the success or lack of it of group-organized projects. Among German or French engineers, it is not generally known when a firm has taken on a job as a member of a particular group or not. CADIC has a good record in the Belgian Congo — for example, the Kwango-Kasai road-axis, with its 26 bridges, and the channeling of the Kwango River — but it is not at present geared to compete seriously much beyond Belgian Africa, and under its present system, costs are high. In contrast, Nedeco's net is extremely far-flung, embracing projects as far apart as Brazil and Burma. They have at least one in the United States — a report on the feasibility of reclaiming the Hackensack Meadows, in New Jersey.

As might be expected from the Dutch, Nedeco undertakes a large number of drainage and reclamation schemes. It evidently is preferred on occasions in places where it would be more usual to find engineers from the appropriate mother country. Nedeco has undertaken projects in Nigeria, Nyasaland, the British Cameroons, and French Guinea, and, in spite of CADIC, in the Belgian Congo and Ruanda-Urundi. It is a sign of the times that this last project, begun in 1959, is the supervision of road-making and the introduction of tea-planting, on behalf, not of Belgium, but of the European Economic Community. It is clear that the Nedeco type of organization is not suitable for countries with a very big engineering profession or many large firms. More of the smaller countries may adopt the Dutch pattern, others may prefer combinations more on the French or German lines. The exact method of organization must vary according to the particular characteristics of the engineering profession in different countries or the needs of particular firms. But whatever form they take, there is no doubt that joint-associations have very definite advantages to offer consulting engineers, and Europe may well see many more of them in the next decade. ▲▲

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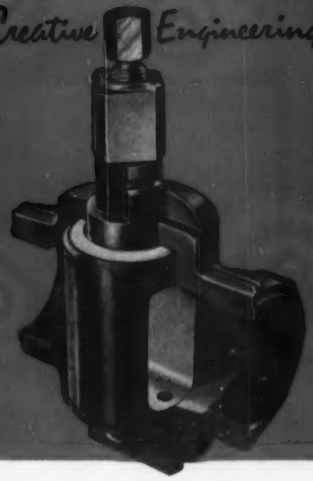

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Fig. 525
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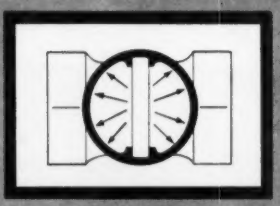
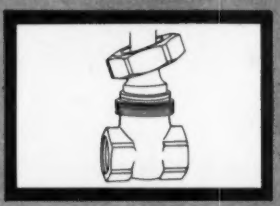
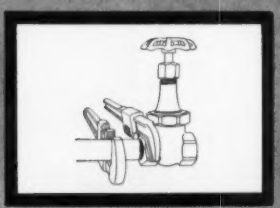


Heavy Bronze Union Bonnet Ring is entirely separate from the bonnet to eliminate any possibility of springing the bonnet face when assembling or disassembling the valve for cleaning or inspection.



The Kennedy wider hex ends are blended into body making the body and hexes one unit. This rugged construction prevents distortion and wrench pressure is absorbed.



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New Council officers are (l. to r.) Fred K. Steel, 2nd vice president; Harold P. King, 1st vice president; Ralph M. Westcott, immediate past president; Hueston M. Smith, president; Lester L. Bosch, treasurer; & George J. Toman, secretary.

CEC Holds Annual Meeting

NO LONGER is Consulting Engineers Council a federation of associations. This came about through the adoption of new bylaws at the Annual Meeting, held in Gearhart, Oregon, May 4-6. Now, each member of each city, state, or regional association is, individually, a member of Consulting Engineers Council. Membership is limited strictly to partners and principals who can represent and speak for their firms, and dues are assessed on a basis of firm size. This gives the Council about 1500 active members representing nearly 1000 firms.

The Council also accepted four new affiliated associations, Massachusetts, New Jersey, Maryland, and South Dakota, representatives from these associations being seated at the meeting as members of the board. There are now 31 associations of consulting engineers in the Council, and every association was represented at the Gearhart meeting. The Council has set a record for attendance probably unequaled in the history of national associations. In its five years of existence, with quarterly meetings during its early years and semiannual meetings more recently, every affiliated association has been represented at every meeting, with the single exception of one missing delegate at one semiannual gathering.

The board of directors also adopted a 1960-61 budget of almost $90,000 and voted in favor of a dues formula that will spread the financial load much more fairly. The formula establishes a curve that starts at $30 and moves upward on the basis of total Social Security payments by the member's firm. The formula is not a straight line but a square root curve. It resulted from a careful study made by a committee headed by John A. Blume, of California. Application of the formula removes the past inequity of the dues structure based on number of partners in a firm. Under the old method, small firms with many partners were assessed unreasonably high dues while large firms with only one or two partners got off all too easy. The new structure eliminates this bad balance.

The $90,000 budget includes sufficient funds to permit the Council

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Our new Manual of School System Specifications is available to consulting engineers. Includes general and typical specs; covers classroom speaker assemblies, call switches, microphones, auditorium systems, etc.

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CONTROL CENTERS

TYPE "MC"

these advantages will help you

MUCH GREATER SPACE SAVINGS . . . because the Arrow-Hart Motor Control Units in these Control Centers are half the size and weight of comparable controls. *ARROW-HART* offers a control center with up to 10 Size 1 control cells in a single vertical section 90" high.

FASTER, LOWER-COST INSTALLATION . . . because all controls are delivered in a single pre-tested, ready-to-install "package." If specified, all interwiring, sequencing, interlocking etc. are pre-engineered.

GREATER DEPENDABILITY . . . because of the superior performance of the individual Arrow-Hart Control Units and simplified maintenance because all controls are centralized in a single convenient location, away from shop dust and dirt. Individual cells are plug-in type for quick removal, replacement or re-assembly.

COMPLETE FLEXIBILITY, VERSATILITY . . . practically any desired combination of units can easily be assembled . . . or modified.

MOST COMPLETE LINES AVAILABLE ANYWHERE . . .

COMBINATION STARTER UNITS: Non-Reversing, Reversing, 2-Speed, Part-Winding, and Reduced Voltage Starter Types in NEMA Sizes 1 through 5 . . . in combination with Fused or Unfused Disconnect Switch or Circuit Breaker of Thermal Magnetic or Instantaneous Trip Type.

ENCLOSURES: NEMA 1 (General Purpose), NEMA 1-A (Semi-Dustight), NEMA 3 (Outdoor), NEMA 5 (Dustight), and NEMA 12 (Industrial Use) — in standard or back-to-back arrangements.

WIRING: NEMA A, B or C — Class I or II.

OTHER CONTROL UNITS: Include Lighting Panels, Transformers, Metering Equipment, and a Complete Line of Pilot Devices.

TYPE MC-5
20" WIDE
Up to 5 Size 1 Control Cells

preferred for most general purpose industrial applications.

GET COMPLETE INFORMATION NOW!
Write today for fully descriptive literature. The Arrow-Hart & Hegeman Electric Company, Dept. CE, 103 Hawthorn St., Hartford 6, Conn.

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Quality since 1890

MOTOR CONTROLS • ENCLOSED SWITCHES
APPLIANCE SWITCHES • WIRING DEVICES

TYPE MC-10
25" WIDE
Up to 10 Size 1 Control Cells

preferred for schools and other commercial, and institutional applications that call for maximum space savings.

to move its offices from Springfield to Washington, but it will not provide sufficient money to set up any lavish office, nor will it allow the hiring of an expensive Washington Director. It is presumed that when the move to Washington is made, the staff will remain as it is now, though this was left to Executive Committee decision.

Present New Manual

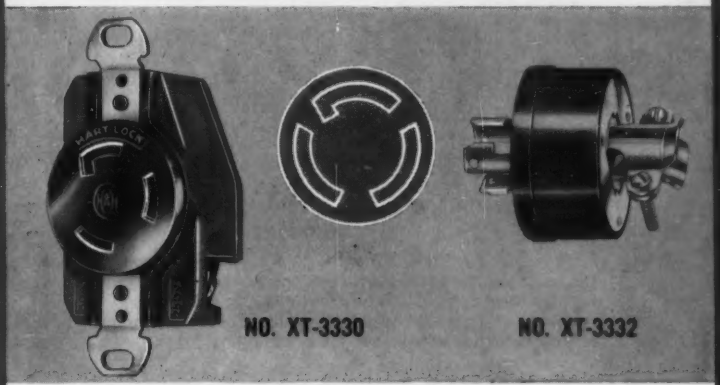
Results of one of the most valuable projects of the Council were put on display at the Annual Meeting. Tom Miles (Oregon) distributed to all present a copy of the new manual, *The Practice of Consulting Engineering*, as put together under the direction of his committee. This is an excellent piece of work (see Books, p. 204), and copies are to go to all firms represented in the Council. After a study of the new publication one director, who formerly had been something less than enthusiastic about this publication project, stated before the meeting that he felt this manual would save his firm its annual Council dues each week of the year. It is a fine publication and demonstrates the quality of the work that can be done by the Council. It corresponds quite closely to the AIA's *Handbook of Architectural Practice*, which was first published in 1920 and is now in its eighth edition. Miles' *Manual* is not yet so polished as the AIA publication, but it will be a long time before it reaches the *Handbook's* age.

The new officers of the Council, elected to serve until next May are: Hueston M. Smith, president; Harold King, 1st vice president; Frederick K. Steel, 2nd vice president; George J. Toman, secretary; and Lester L. Bosch, treasurer. Ralph M. Westcott also is a member of the Executive Committee as immediate past president.

The semiannual meeting of Consulting Engineers Council will be held November 9-11, at the Penn Sheraton Hotel, in Pittsburgh. ▲▲

ARROW AH HART

NEW HART-LOCK HEAVY-DUTY DEVICES FOR INDUSTRIAL INSTALLATIONS



NO. XT-3330 NO. XT-3332

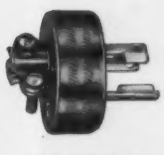
SINGLE 3-WIRE HART-LOCK RECEPTACLES, CAPS AND CONNECTORS—30 AMPERES, 250 VOLTS

Developed to insure safety in heavy-duty installations, this new line of Hart-Lock devices provides complete protection for industrial and commercial equipment that operates on 250 volts. The receptacle has black, glazed porcelain finish contact face, or is available with "NO-TRAK" face for heavy-duty industrial equipment. Serrations around terminal screws provide a secure grip for wires. Configuration prevents interchangeability with 20 amp Hart-Lock caps, connectors and receptacles. Caps and connectors have rubber ridge for better finger grip. Available in Arrow-Hart's exclusive armor-over-rubber construction. Grounded units are also available.

"H&H" SPECIFICATION GRADES

DUPLEX 3-WIRE GROUNDING RECEPTACLES AND CAPS—15 AMPS, 277 VOLTS

Provides positive grounding for commercial fluorescent fixture installations equipment, plus locking to prevent accidental disconnect. Available both back wired and side wired, receptacle has 2 green hex grounding screws. Caps available in rubber or in armor-over-rubber.



NO. XT-4776 NO. XT-4750

There are Arrow-Hart locking devices for every industrial, commercial and residential application. And each A-H device is designed for easy, fast installation and safe, reliable operation. Your customers will appreciate the added protection of Arrow-Hart products. Write today for information.

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ENCLOSED SWITCHES · MOTOR CONTROLS

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Radiant Heating and Cooling is handled by a dual system in Salt Lake City's First Security Building. Easily installed steel pipe carries steam for heating, chilled water for cooling and does it efficiently and economically.

In the nation's buildings **steel pipe** does many jobs more efficiently, more easily, and at less cost . . . .

Accepted without question is the efficient and reliable performance of *steel pipe* in the nation's commercial, industrial and residential structures. And for multiple reasons.

Service-wise—*steel pipe* fills many functions well, long and efficiently. Engineering-wise—it has the inherent strength and dimensional stability to withstand the toughest service over continued periods, and it is easy to form and join. Cost-wise—no other metal tubular product offers more for less . . . ready availability, low initial cost, low installed cost and low per-year service cost.

These are only some of the reasons why *steel pipe* is the most widely used pipe in the world for vent and drainage lines, heating and cooling, snow and ice melting, refrigeration and freezing, fire protection systems, electrical conduit and structural uses, and water, steam, air and gas lines.

Sprinkler System and Stand-Pipe Fire Lines in Travelers Insurance Boston building are durable steel pipe. Savings in initial and installation costs were considerable; insurance premiums were less with steel pipe fire protection systems on guard throughout the structure.

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Insist on MADE IN USA Steel Pipe

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COMMITTEE ON STEEL PIPE RESEARCH

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Split Atom Show Fizzles

MARJORIE ODEN
Eastern Editor

THE NUCLEAR SCENE is so dotted with future shows that rumor has it exhibitors leave their merchandise packed between showings. Since Engineers Joint Council and the American Nuclear Society — Atomic Industrial Forum decided to go their separate ways last year, the nuclear itinerary has become most complicated.

Engineers Joint Council recently held its Nuclear Congress in New York City, and it could have been better. Attendance was listed at 5000 (or 4000, depending on whose figures you use). This compares with 11,000 at the last combined EJC-ANS-Forum show in Chicago, two years ago.

Reconciliation Attempts

EJC has made a real effort to get the shows back together, giving the appointed negotiation committee carte blanche to agree to any reasonable suggestions for future shows put forth by ANS and the Forum, but no luck so far.

There had been some talk of EJC holding a Congress next year in Chicago, but the ANS and Forum show next year will be in Chicago, so EJC dropped these plans. Instead, EJC has announced that future Nuclear Congress' will be held semiannually, with the next one set for 1962 in New York City. In order not to make a bad situation worse, all EJC member organizations will be requested not to hold major nuclear meetings for six months before or after the Congress.

In the meantime, ANS and the Forum have announced a December meeting and show in San Francisco, followed by another big exhibition scheduled for November 6, 1961 in Chicago in conjunction with the ANS winter meeting.

ASME President on Program

Actually, the EJC Congress deserved better attendance than it got. The papers were on good topics and were well presented by real experts. Walker L. Cisler, president of the American Society of Mechanical Engineers and head of Atomic Power Development Associates, Inc., which is designing and building the Enrico Fermi Nuclear Power Plant, near Detroit, summarized power developments since the revision of the Atomic Energy Act in 1954, which allowed private industry to own and operate nuclear power facilities.

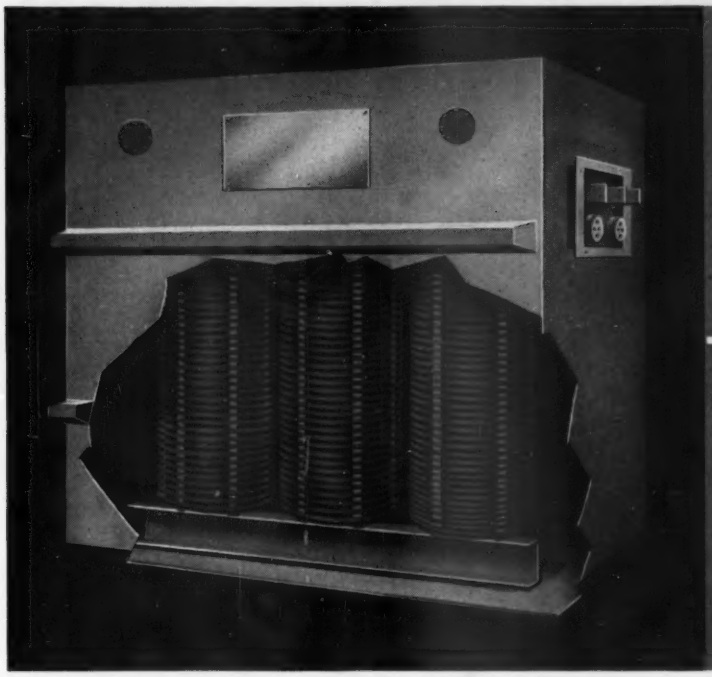
"Today more than 132 of the nation's electric power companies are engaged in broadly diversified programs for the development of competitive atomic power," Cisler said. "Three nuclear power plants in which investor-owned electric companies are participants are in operation, and three more are scheduled to come into operation soon. By the end of this year, or shortly thereafter, these will provide a [generating] capacity of about 490,000 kilowatts.

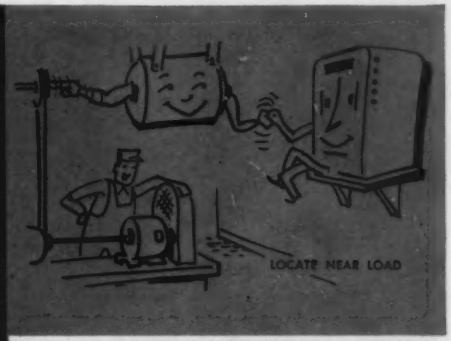
"Eight more electric power company sponsored projects are under construction, design, or contract. Three additional plants are in the planning stage, and two of these are in active negotiation. These 17 nuclear power projects will cost an estimated $650 million and create a nuclear power capacity of about 1.8 million kilowatts.

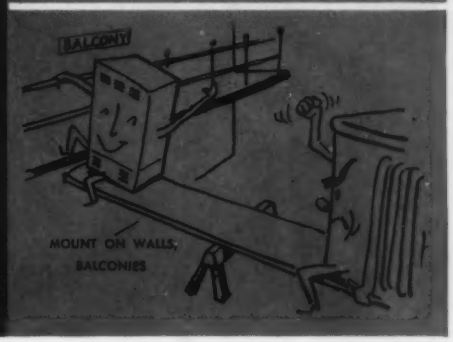
"A nuclear power plant must justify itself either in low cost kilowatt-hours or in information and data acquired. At this time, and apparently for some years to come, a nuclear plant costs us money just to operate. Therefore we must use it as a research tool, as a means of getting experience, in which case it can be worth every dollar

SILICONE NEWS from Dow Corning

Power Where You Want It







Check Inside: Where a Transformer Can be Located Is Largely Determined by its Insulation!

Whether you're modernizing or installing a completely new power distribution system, you can make certain that transformers will fit easily into any plant layout by specifying silicone insulated dry-type units.

Locate them near the load . . . on the floor, a balcony or the wall . . . anywhere! Insulated with Dow Corning Silicones, they are light-weight . . . space saving. Frequently no more expensive initially, they cost less to install, less to maintain, far less in the long run. Here's why:

Lowest Cost Installation: Easier to handle and easier to install, they require no costly vaults or barriers . . . can be placed right at load or load center for additional savings on costly low-voltage cable.

Lower Operating and Maintenance Costs: Virtually maintenance-free, silicone insulated transformers have no liquids to filter or change. Need no space heaters to keep windings dry when de-energized.

Maximum Reliability: Depending on design, they withstand overloads of 25% to 50% and more above rated capacity. The extra thermal capacity of silicones assures uninterrupted, reliable power.

Maximum Safety: Completely dry and completely safe, you can locate silicone insulated, dry-type transformers almost anywhere! No danger of fire . . . no toxic fumes. These units prove safe even under extreme overload and short circuit conditions.

Today, transformer manufacturers offer two basic designs insulated with Dow Corning Silicones — *sealed* and *open* dry-types.

For Load Center Unit Substations, you can achieve maximum reliability and minimum maintenance with a silicone insulated *sealed* dry-type unit. Requires only a periodic check of pressure gauge and bushings.

Or you can save weight by specifying a silicone insulated *open* dry-type unit. Up to 40% lighter than non-inflammable liquid filled units, they're ideal for balconies and other minimum floor loading areas.

Lighting Transformers and wall-mounted units are lighter per KVA than any other type. Locate them right at the load and save valuable floor space. They provide uninterrupted reliable power despite contaminated atmospheres, dust, dirt, moisture or high ambients.

Send today for full information on silicone insulated, dry-type transformers and list of manufacturers offering equipment insulated with Dow Corning Silicones.

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SPECIFY Dow Corning Silicones and **SAVE!**

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Dust and Fume Collection by Norblo

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Norblo Automatic Bag Type

For continuous and heavy duty service at constant capacity and efficiency, Norblo Automatic Bag Type collection pays its own way — in recovery of valuable materials or removal of injurious or "nuisance" industrial air contaminants. Norblo builds the entire installation, from blowers to bag-cleaning mechanisms. Complete systems are engineered to meet specific situations. Norblo engineering insures low maintenance and no shut-downs — guarantees performance of every installation.

Norblo Standard Bag Type Collectors

Based on the same construction principles, the standard bag type collectors provide at low cost the high efficiency service that is obtainable only from bag-type cloth filtering, with either compressed air or electrically driven periodical bag shaking and cleaning. Units must be shut down for cleaning — at such times as the noon hour and end of working day.

Norblo Portable Type

For excellent results in localized dust control, Norblo Portables protect equipment and reduce maintenance in grinding, polishing and cutting departments. Six models cover capacities from 300 to 1350 cfm., at 8" static pressure at the fan. Occupy small space. Are unusually quiet.

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that we expend. But it should be obvious that to multiply the number of plants beyond a certain point would merely duplicate information without adding much to it."

Fuel Economy

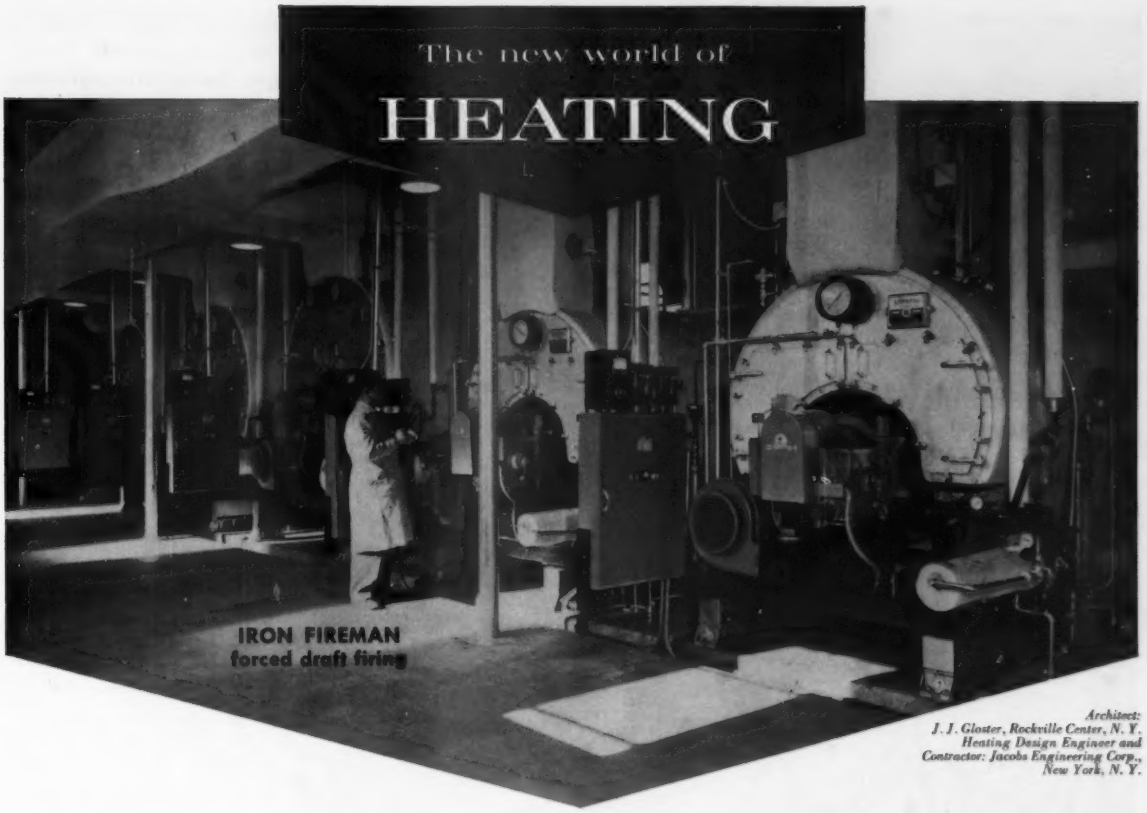
Cisler also predicts possible future time savings through use of liquid and paste fuels, which would simplify the fuel cycle. Equally, or even more important, is the attainment of a reliable technology for the use of plutonium in reactors. Uranium cannot be the final answer because it permits the use of only a fraction of the heat potential.

A United States delegate to the Geneva conference on Peaceful Uses of Atomic Energy, Cisler thinks the European picture has changed greatly within the past few years.

"A leveling off in economic growth, together with widespread conversion to oil, led to oversupplies of coal in various producing centers. Concurrently, large reserves of oil and gas were found in the Sahara, Libya, and elsewhere . . . Consequently, Europe is now nearer to the situation existing in our nation and in the Soviet Union, where nuclear development is proceeding with due consideration to the large reserves of conventional fuel available, the cost of nuclear construction, and the work that must yet be done in exploring this new technology before competitive power costs can be achieved."

French Report Progress

The French, proud of their recent nuclear development, were very much in evidence around the Congress and the exhibition. They announced that "Important contracts already have been signed with foreign countries for the delivery of materials or the construction of installations, such as the plant for refining uranium in Portugal, or the laboratory for the study of irradiated fuels in Karlsruhe. Finally, a [French] technical and industrial



Architect: J. J. Gloster, Rockville Center, N. Y. Heating Design Engineer and Contractor: Jacobs Engineering Corp., New York, N. Y.

"Today's package units remove uncertainty"

says Mr. Fred Reidel, Chief Engineer, Mid-Island Hospital, Bethpage, L. I.

"The old-fashioned way of installing boilers," says Mr. Reidel, "required that we get separate estimates for burners, steel front plate, brick combustion chamber, oil heating equipment and wiring. Everything was assembled at the site. Now the finished unit is simply lowered into place and bolted down."

A single contract not only keeps your installation costs under control, but greatly reduces these costs as well. It also narrows responsibility for the proper installation and functioning of the equipment.

Easy to size and specify. After determining the required load and deciding on the fuel (gas, oil or dual-fuel combination), it is only necessary to refer to a chart to find the correct size of unit, or units, for your job.

Multiple units have many advantages. You can have a tailor-made plant with low initial cost. A stand-by unit protects you against emergencies or peak loads. You can split your plant between high and low pressure boilers to meet special needs, or between steam and hot water units. Capacities range from 10 to 650 boiler horsepower.

For full information, please mail the coupon below

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HEATING AND AIR CONDITIONING
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Iron Fireman Mfg. Co., 3072 West 106th St., Cleveland 11, Ohio. (In Canada, 80 Ward St., Toronto)
Please send complete technical descriptions and specifications for oil, gas or oil-gas combination firing.

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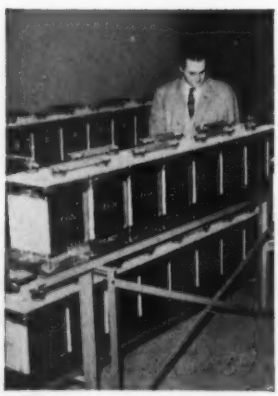
When lights go out

The Exide Emergency Lighting System takes over



Emergency power source Powerful Exide Batteries can handle lighting loads for entire buildings. Long service life—up to 25 years is common.

This emergency system prevents losses from panic, injury, damage and theft.

Sudden darkness from power failure can bring heavy losses. You need Exide Emergency Lighting Systems to provide the necessary illumination at such a time.

It is wise to plan for this fail-safe source of light when the building is designed. Exide supplies systems to suit structures of any kind and size—theaters, schools, hospitals, stores, factories and public buildings. Plan for long-range economy with the built-in protection of Exide Emergency Lighting Systems. Get all the facts—write Exide Industrial Division, The Electric Storage Battery Company, Philadelphia 20, Pa.

Exide®

The Electric Storage Battery Company

mission now is engaged in studying for the Indian Atomic Energy Commission the construction north of Bombay of a natural uranium power plant with a power [output] of 250,000 kw."

When the French AEC was formed in 1945, no uranium deposits were known in France or its possessions. At the present time, France is the leading uranium producer in Europe and the fourth in the West. The French AEC has a current annual budget allocation of $200 million.

Perhaps one of France's most notable accomplishments has been in the field of nuclear education. A graduate course has been established for engineers and scientists. Shorter courses are provided for students in the provinces. On-the-job training combined with nuclear courses is planned for teachers during summer vacations. In addition, at the request of OEEC (the Organization for European Economic Cooperation), the Nuclear Institute organizes two-week seminars each year for teachers and industrial executives from all countries in that international organization.

U. S. Developments

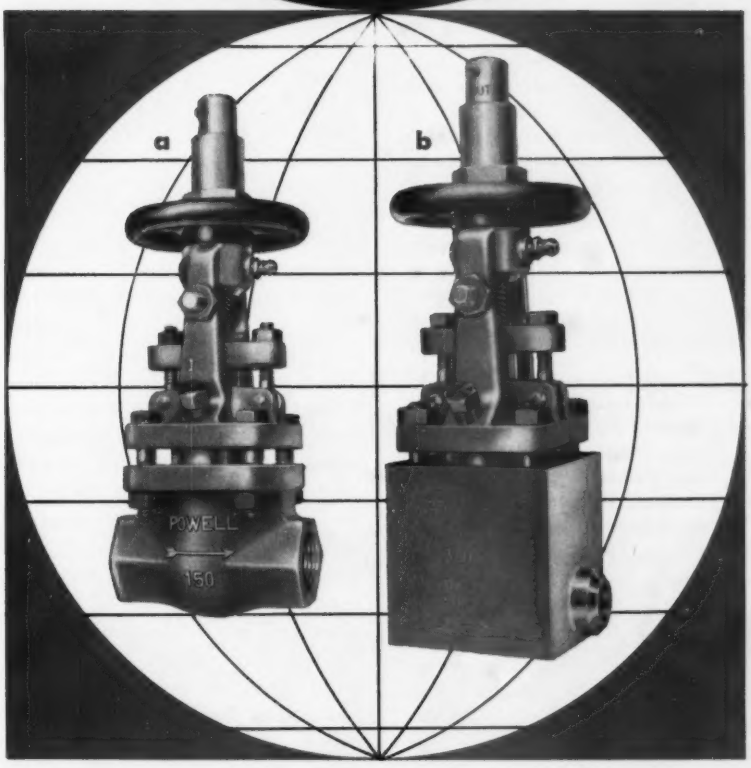
Several U. S. government departments reported to the Nuclear Congress their progress to date. Francis J. Weber, chief of the Public Health Service division of radiological health, began on a not-too-cheerful note. "The constantly deepening respect given by scientists to the problem of radiation exposure is indicated by the consistent downward revision, over the past 30 years, of the annual maximum levels of ionizing radiation considered permissible by the National Committee on Radiation Protection and other authoritative groups. It was dropped from 60 rems for workers occupationally exposed (in 1931-36), to 30 rems (1936-48), to 15 rems (1948-58) to 5 rems at the present time. Each downward revision has increased the responsibility of those concerned with the

Performance makes the world of difference

In step with the times, Powell designs and makes valves to successfully handle the fluids that are necessary in the operation of atomic power plants, submarines and merchant ships.

These valves are absolutely leak tight and can be depended upon to render long unfailing service—the result of Powell's constant quality control of materials and manufacturing methods, precision machining, cleaning and degreasing of all parts, and thorough testing.

For complete information consult your nearest Powell valve distributor or contact us.



a

Stainless Steel Screwed End Globe Valve for 150 pounds W.P. Because of the specially designed stuffing box, and the special gasket at the body-bonnet joint, these valves are absolutely leak tight. Provided with an extension stem coupling for remote operation.

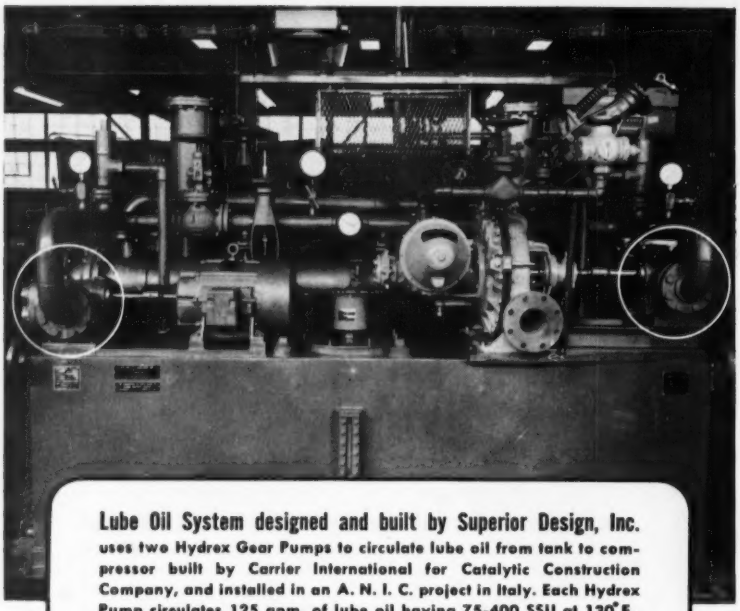
b

Stainless Steel Block Type Globe Valve for 300 pounds W.P. Butt welding ends. Inner Bell-o-Seal construction protects lower section of stem against any corrosive action of the fluid being handled and makes the valve packless. Valves are fitted with an extension stem coupling so they can be remotely operated.

THE WM. POWELL COMPANY
Dependable Valves since 1846
Cincinnati 22, Ohio

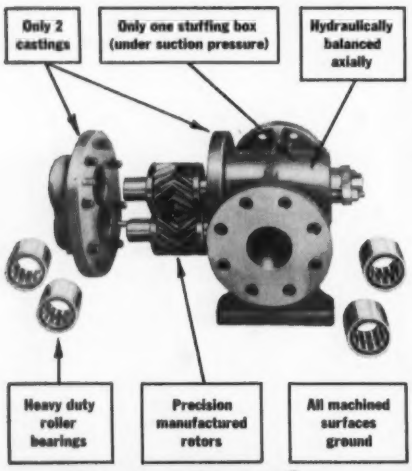
Powell . . . world's largest family of valves

Sier-Bath HYDREX® PUMPS
provide high-capacity pumping in compact space



Lube Oil System designed and built by Superior Design, Inc. uses two Hydrex Gear Pumps to circulate lube oil from tank to compressor built by Carrier International for Catalytic Construction Company, and installed in an A. N. I. C. project in Italy. Each Hydrex Pump circulates 125 gpm. of lube oil having 75-400 SSU at 130°F., at 75 psi. under flooded suction. One pump is motor-driven, the other is turbine-driven, both operating at 1450 rpm.

Sier-Bath HYDREX PUMP


Only 2 castings
Only one stuffing box (under suction pressure)
Hydraulically balanced axially
Heavy duty roller bearings
Precision manufactured rotors
All machined surfaces ground

The simplest heavy duty gear pump made! Use it in place of pumps costing much more... for handling chemicals, fuel oils, lube oils, hydraulic liquids, etc.

The "Hydrex" needs no costly speed reducer—can be direct-connected up to 1800 RPM. Extreme simplicity allows heavier construction, easier installation and maintenance, less downtime, longer life.

Models available to pump liquids from 32 SSU to 500,000 SSU, at 1 to 350 GPM, up to 500 PSI. See "Yellow Pages" for your local Sier-Bath Pump Representative or write to *Sier-Bath Gear & Pump Co., Inc., 9257 Hudson Blvd., North Bergen, N. J.*

Sier-Bath ROTARY PUMPS

Screw Pumps — Gearex® Pumps — Hydrex® Pumps

Founded 1903 — Mfrs. of Precision Gears, Rotary Pumps, Flexible Gear Couplings — Member A. G. M. A.

problems of protection from radiation," Weber reported.

The Army Nuclear Power Program is reported to be concentrating on a "versatile family" of nuclear power plants for use by all three military services all over the world. This "family" was described as including a variety of stationary and mobile low, medium, and high power plants, ranging from less than 1000 kilowatts to more than 10,000 kilowatts.

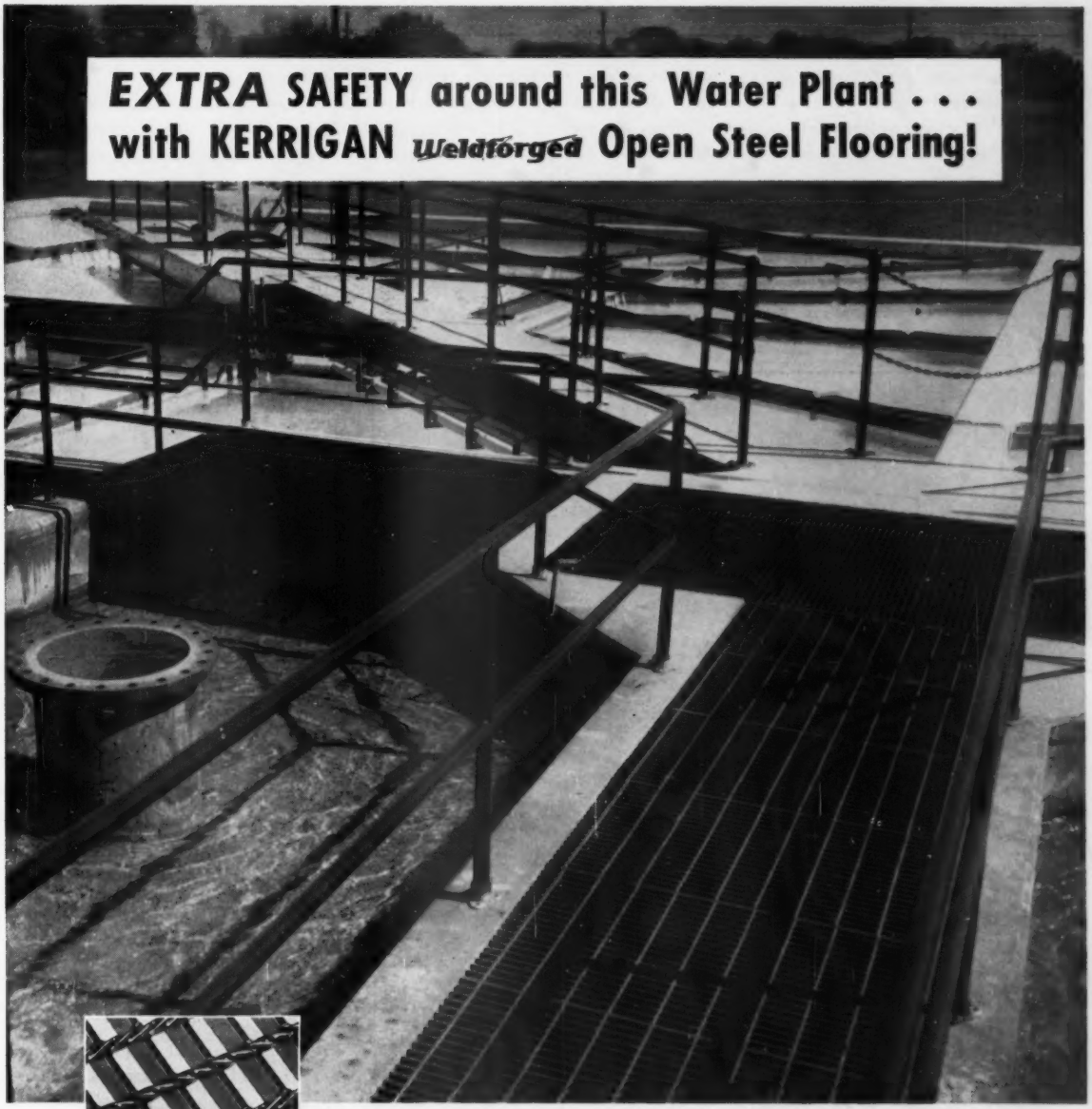
The U. S. Bureau of Yards and Docks is planning nuclear facilities for the Navy. It is concentrating on nonself-propelled, barge-mounted or self-elevating mounted (Texas tower type) plants for supplying power to waterside bases and on modular skid-mounted plants for use at various Antarctic locations where fuel is a problem.

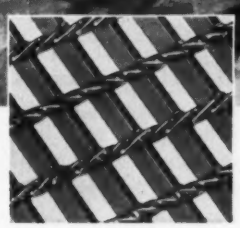
The New York State Office of Atomic Development presented a report, announcing an "Isotopes in Industry" educational program, designed to increase the number of industrial users of radioactive isotopes in New York State. Between 1946 and 1957, New York led the nation in the utilization of isotopes for research and quality control. Since then, industry usage has leveled off.

Design Problems Discussed

R. W. Kupp, chief nuclear engineer, and J. C. Tourek, vice president, Vitro Engineering, sought to dispel some of the "aura of mystery" surrounding nuclear design and construction. They discussed: ¶ Site Selection – a nuclear facility does not differ from a conventional station in the broad evaluation concept. The importance of center of load location, adequate cooling water, good foundation conditions, low land cost, and adequate labor supply are similar for a nuclear plant and any other power plant. Perhaps the geology is somewhat more significant because of heavier foundation loads and land cost may be more critical because of the larger site requirement. Other im-

EXTRA SAFETY around this Water Plant . . . with KERRIGAN *Weldforged* Open Steel Flooring!





TWISTED Cross Bars *ALTERNATE* right & left for an *EXTRA* margin of Walking Safety

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portant characteristics to be considered in selecting a site for a nuclear plant are hydrology, seismology, and population density.

¶ Containment – a relatively conservative approach has been established for the design pressure of containment vessels. Calculations usually assume the instantaneous release of all the energy contained within the reactor system and the equilibrium of this energy with the atmosphere within containment. It is suggested that these conventional codes could be relaxed to some extent. As an alternate to the steel containment vessels, prestressed or reinforced concrete have been considered both above grade and below. Although a prestressed tank is theoretically completely tight, its ability to stay free of microscopic cracks under the varying temperature conditions present in a nuclear plant is questionable. Meeting the specification of less than one percent leakage at a significant pressure is difficult to achieve.

¶ Waste Disposal – The majority of plants have taken a very conservative approach on gaseous discharge and permit a concentration within the stack which is less than or close to the continuous exposure tolerance. In other words, from a radiation standpoint, you could live in the stack and not be subject to harmful radiation exposure.

Fuel Conservation

Gale Young, vice president of Nuclear Development Corporation, is concerned about the conservation of the world's fossil fuels. "We already are destroying our fossil organic material at a prodigious rate, and that rate is increasing every year. Having burned over the surface of the world (the forests), man . . . now is proceeding to gut the interior.

"Nuclear reactors are now 17 years old – a tenth the age of heat engines. It is time that they were put to work, even if they still have some growing up to do. First, because they will grow up faster out trying to do a man-sized job than they will lolling around the house; and second, because time is urgent for the job they have to do.

"Atomic energy and solar energy will be partners on the job. By solar energy I mean both the direct mechanical kind . . . and the indirect agricultural kind . . . While atomic energy may have the more important role in the near future, solar energy probably will dominate in the long run.

"One welcome by-product . . . will be the reduction or virtual elimination of smoke, soot, and smog."

Young's order in which he thinks nuclear power should be put to work is:

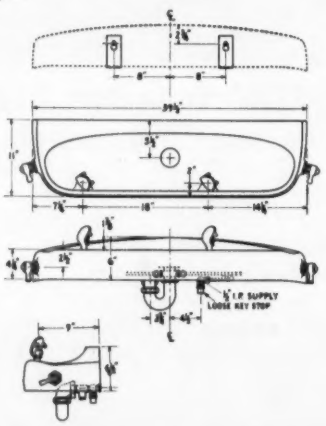
1. Central electric stations.
2. Industrial power generating and process heat plants.
3. Domestic uses.
4. Transportation. ▲▲

2 BUBBLER BEAUTY

HAWS MODEL 10F

IN COLORFUL FIBERGLASS

DECORATOR 5 COLORS



An accent of color with the graceful sweep of clean design – that's the new HAWS 2-bubbler Model 10F! Patterned after the popular Model 10Y (3-bubbler fiberglass model), this tough, vacuum molded fiberglass plastic unit is equipped with HAWS exclusive anti-squirt, vandal proof fountain heads. All visible trim is chrome plated. Select white or any of *five* decorator colors at no extra cost.

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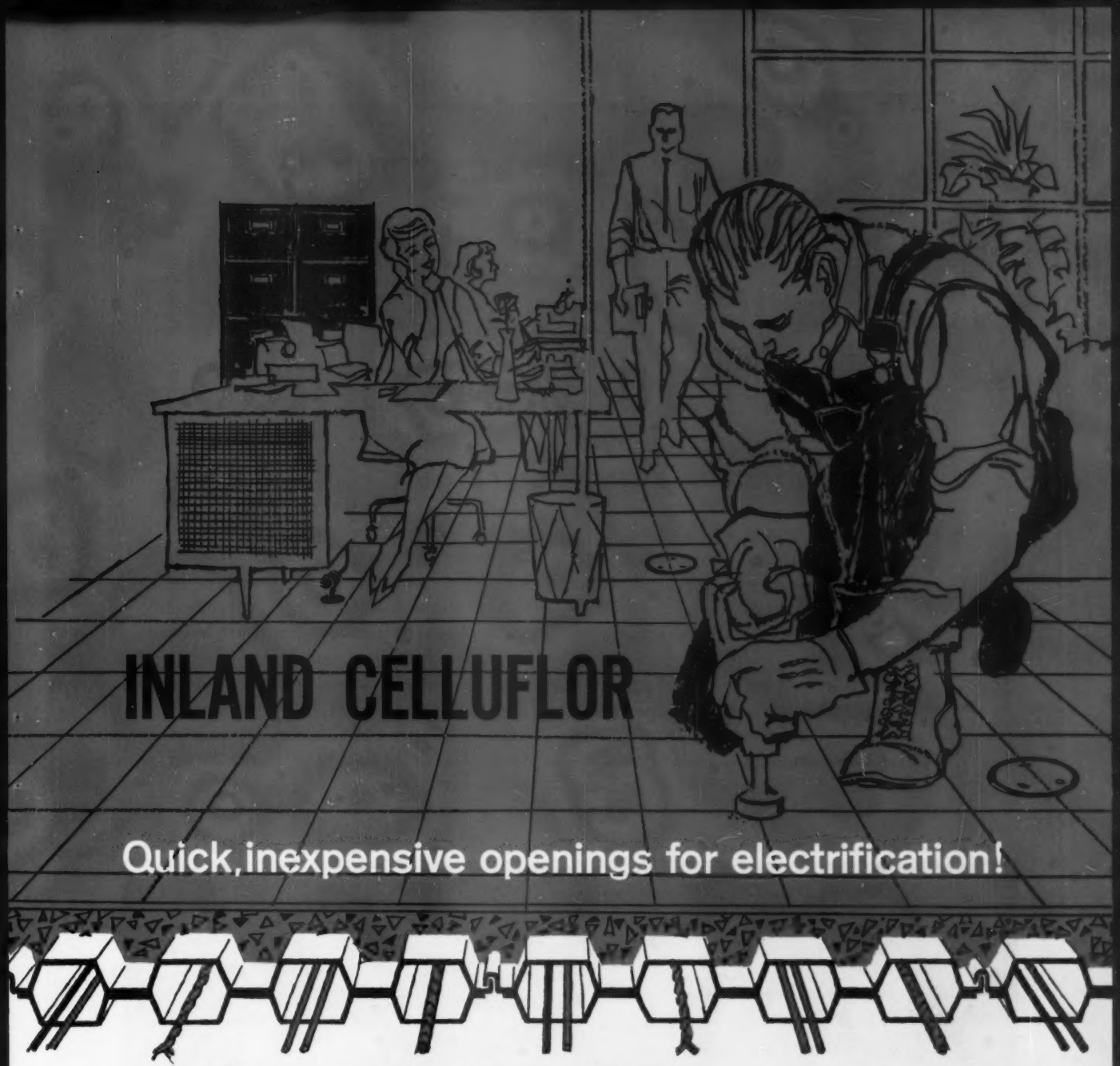

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Many buildings with a future use this floor with a future — including Union Carbide office building, New York City, and Kaiser Center office building, Oakland, California.

There are other advantages of Celluflor — savings of steel, footings, construction time, and overhead. See Sweet's — or write for Catalog 270.

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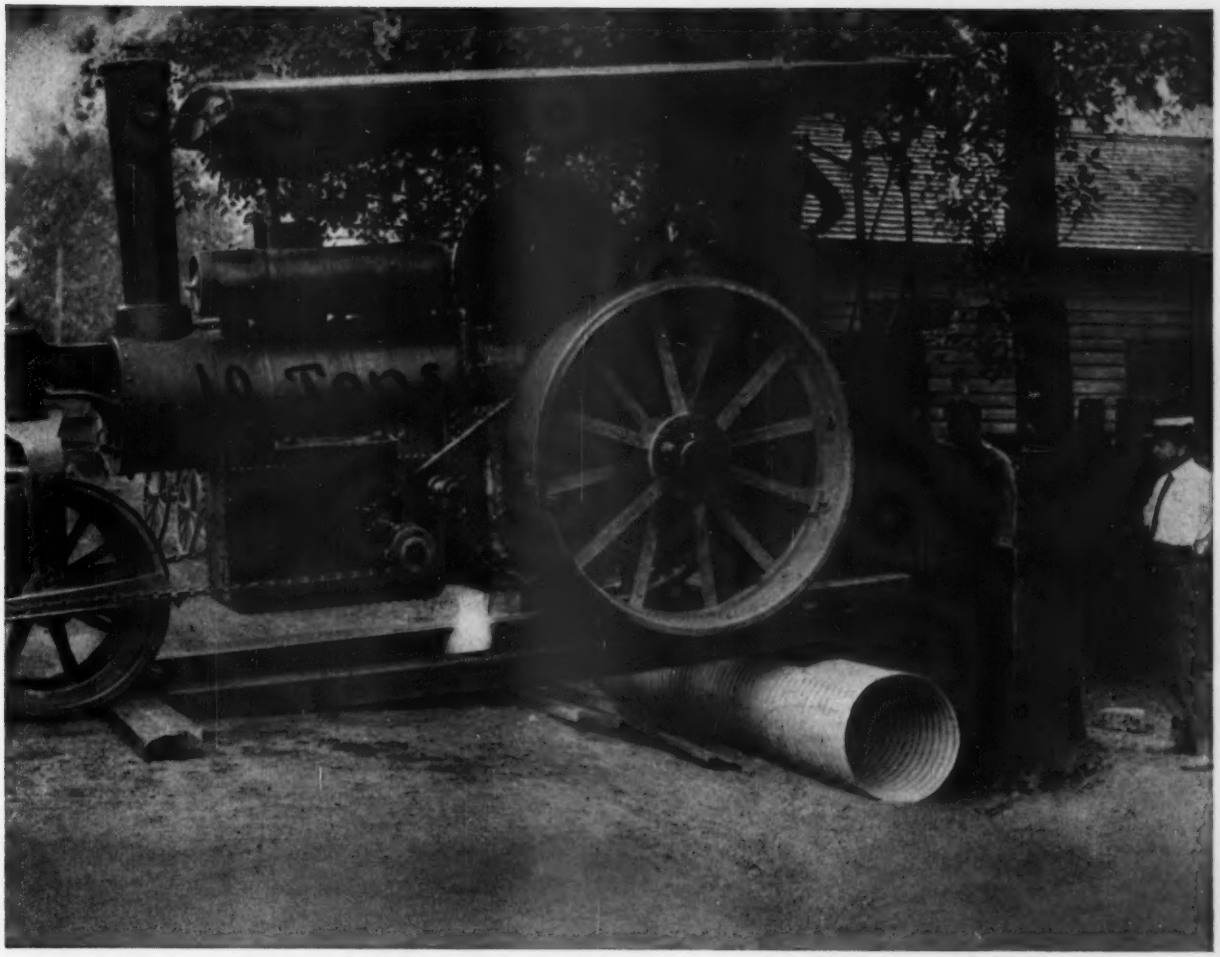

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5

1. Inspection shows sewer in Pocatello, Idaho, installed in 1914, is in excellent condition. 2. Armco SMOOTH-FLO® Sewer Pipe being installed for real estate development. 3. This Armco Pipe functions as a conduit for utility lines under railroad. 4. Armco Research Engineer checks 20-year performance record of Armco Pipe under the Pennsylvania Turnpike. 5. Conveyor housing is a 96-inch diameter Armco Pipe.

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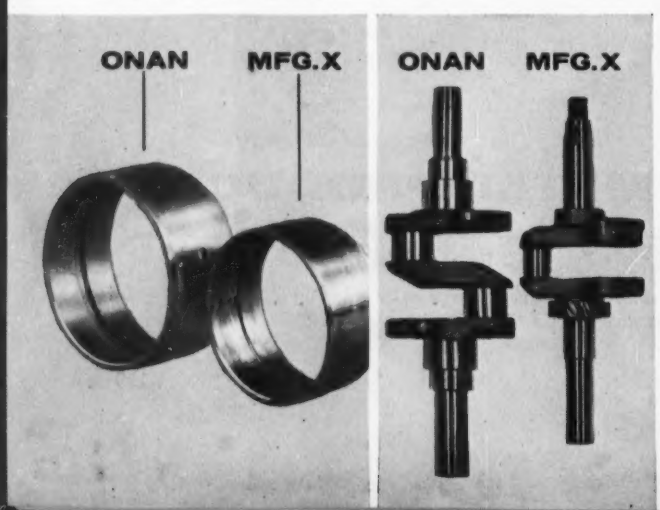

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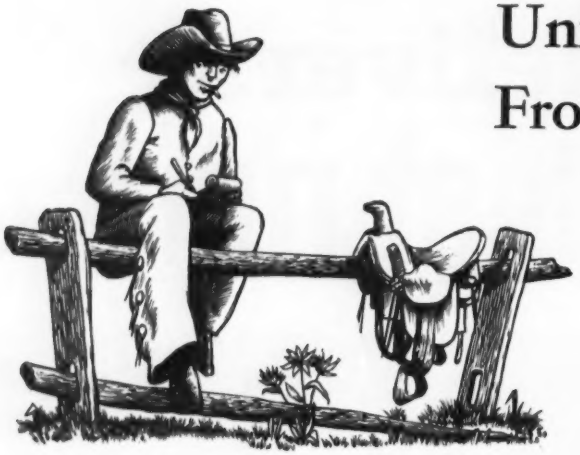


Unfair Competition From Your Alma Mater

RALPH S. TORGERSON
West Coast Editorial Representative

A Report from the West Coast

CONSULTING ENGINEERS quite naturally have a kindly feeling toward their alma mater and organizations with which the school is affiliated – except when occasions arise that are felt to be injurious to their profession and their own personal interests. Many consultants, for example, are disturbed about some of the research organizations associated with universities for their unfair, if not unethical, competition with private enterprise in the fields of engineering research and design.

In most instances these research groups use the name of the university, or assume another high-sounding name, with liberal references to the academic standing and degrees of those associated with the enterprise. Sometimes they start out by offering to make an economic survey, and then later solicit the engineering design work to complete the job. To further compound their devious methods, they stress that their services are "unbiased" because they are a nonprofit agency affiliated with a university, and all of their associates are professors. This, in turn, casts an implication that firms of consulting engineers are biased in their approach to problems because they are engaged in private enterprise for profit.

A parallel may be drawn between these research groups and the governmental agencies that are encroaching on the domain of private enterprise. The state universities, and even private schools of engineering, too frequently are looked upon as service agencies for the public, and therefore held free to offer their services on a different basis than private enterprise organizations, often without regard to the accepted concepts of fair competition.

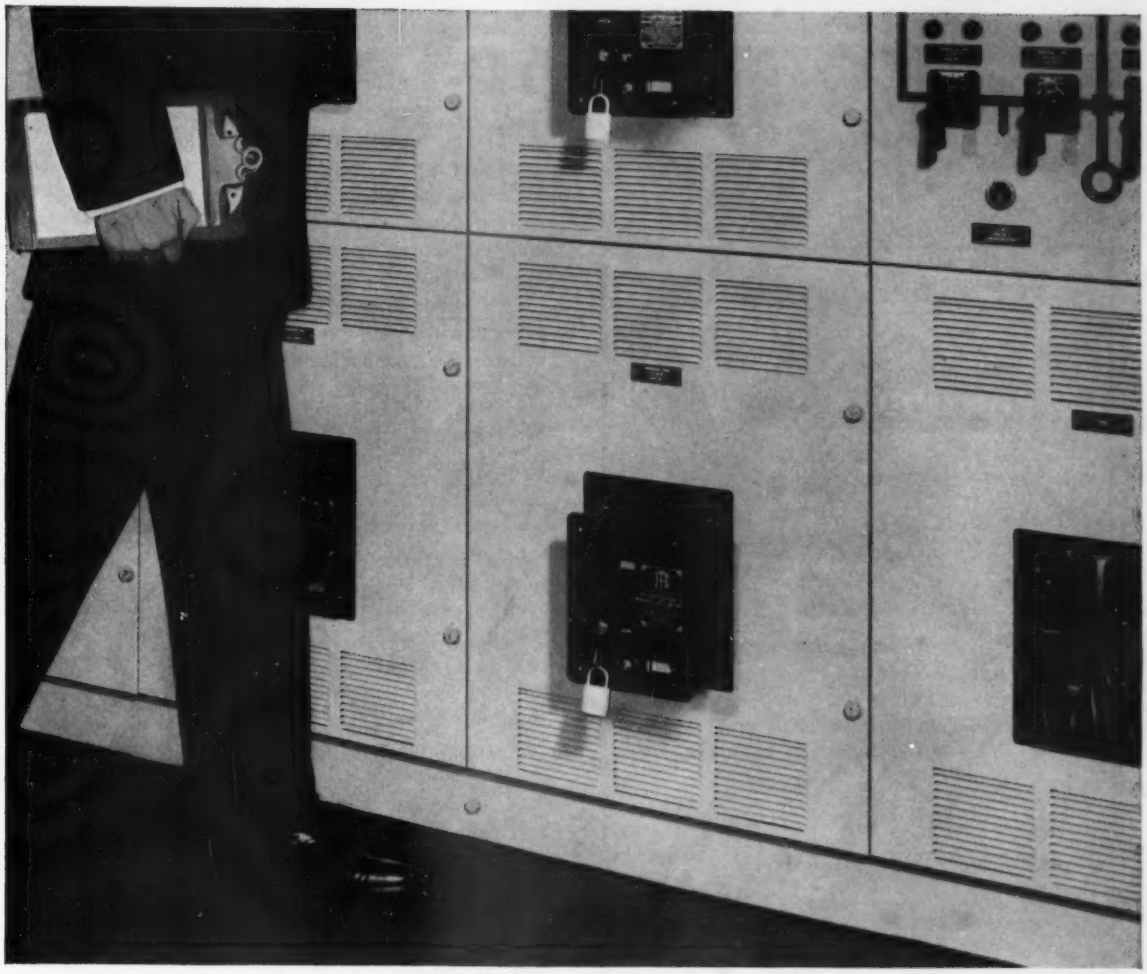
Part of the fault lies with the engineering profession in taking a timid approach to this problem. An effort should be made to provide a strong statement defining an acceptable and ethical basis of operation for tax-free institutions and professor-consultants. There undoubtedly is a field for university research groups. Certain basic research work requiring specialized knowledge might be conducted to better advantage by these organizations than by a private consulting firm whose primary function is design work. But basically the activity should be limited to providing services that cannot be furnished by existing taxpaying private organizations.

How Moonlighting Starts

In commenting on research groups, one prominent consulting engineer in the Pacific Northwest said, "When you start to explore the entire problem of unfair competition from members of engineering faculties, you are heading into a subject loaded with complexities involving even philosophies of government and education.

"I doubt that there is any engineering school in the country that does not have members of the faculty who are at some time called in on some project, either because they have specialized knowledge as the result of advanced academic work or because the school has special instruments or equipment available for use in helping with problems. As an outgrowth of this, a number of engineering schools of my knowledge have set up departments to aid in the solution of problems brought to them. There is no question that this extends to design and, taking a personal view, results in direct competition with the consulting engineer.

"How does the research foundation and moonlighting by members of the engineering faculties get a foothold? It is encouraged. It stems, in my opinion, from the basic philosophy of most institutions of higher learning to the effect that they are established by the people and are a service agency



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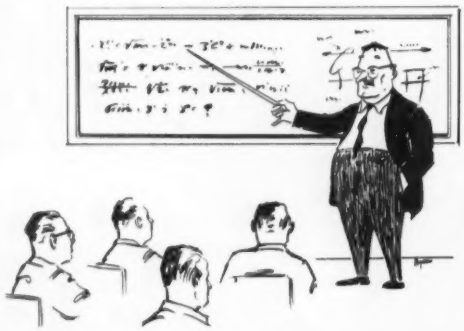
"This, it seems to me, is the background. From this has developed free engineering and some engineering not so free. While the type of free engineering consulting engineers have talked about most is declining, if not vanishing, this new type of free engineering seems to be in ascendancy. The research foundation is certainly an example.

"An attack seems in order. Yet, an attack is fraught with a number of problems and angles involving the entire philosophy of the purpose for which colleges and universities are established."



"And that's as far as we can go with the problem because I discovered the solution during a sponsored research program, and therefore it is the property of Double Bubble Soap Company."

Paying Professors To Hide the Truth

One excellent argument against commercially sponsored research by universities and colleges was overlooked in the comments by consultants. The real reason for the existence of a school is the education of the students. The professors are employed to pass on their knowledge to the next generation. Ethically they are expected to teach the truth – the whole truth. They are not to conceal from their students any knowledge they may have in the field in which they are instructing. Yet, if a professor is engaged by a commercial organization to undertake private research work, the results of which are to be kept secret, he then is put in the position of one who must withhold important knowledge from his students for commercial reasons. Therefore, no educational institution should undertake a research project unless the results are to be public knowledge. No teacher should be paid to hide the truth from his students.

Must Keep Researchers Busy

John A. Blume, of John A. Blume and Associates, San Francisco, expresses the view that, like public agencies, nonprofit research organizations have definite bureaucratic tendencies. "It stands to reason," said Blume, "that any organization which tends to build up extensive personnel, particularly with the aid of tax-exempt status, will attempt consciously or subconsciously to keep that personnel busy. This tends to encroach into existing fields of effort or to unduly increase the cost of work that the organization may be doing on a cost-plus basis.

"The whole bugaboo about 'profit' is greatly overemphasized since the actual profit that private consultants have available is, in my opinion, often much less than the savings in cost to their client that come about through their use.

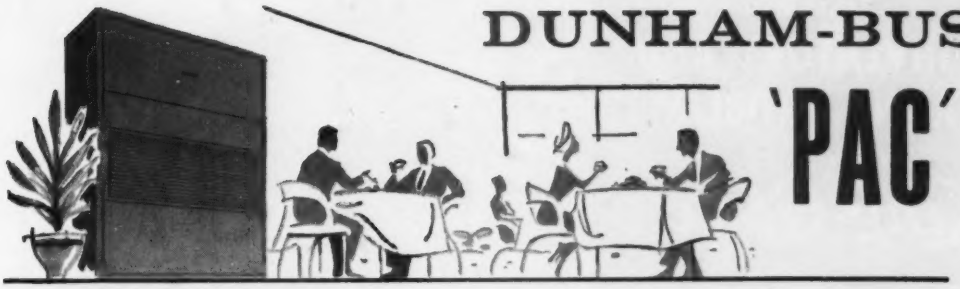
"It is not necessary for an organization to be nonprofit in order to do research, even of a basic nature. We have a special division that does research, and we feel that in its field of structural dynamics it is very efficient and certainly unbiased.

"It is not true that a group has to be identified with a university in order to provide unbiased, disinterested service to the client. Independence – lack of bias – has nothing to do with whether or not engineers are connected with a university or whether they make a profit in their operations.

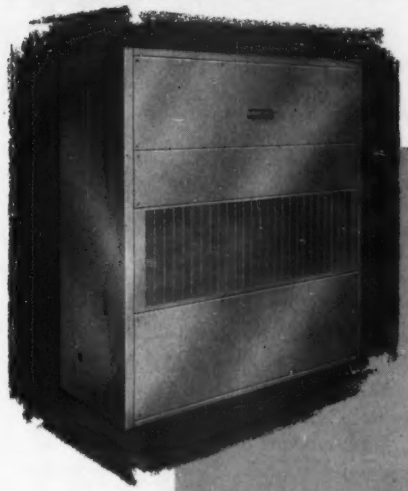
"I definitely believe there is a field for university connected research organizations, but I believe this field should be limited to providing research and other services that are not, and cannot be, provided by existing organizations that not only do such work and do it well, but also pay taxes and support public and educational institutions."

Operating Methods and Results

Several consultants advanced other practical reasons for apprehension over activities of research groups in the field of engineering design. Referring specifically to university professors associated with research foundations, Harry R. Powell, of Harry



DUNHAM-BUSH 'PAC'



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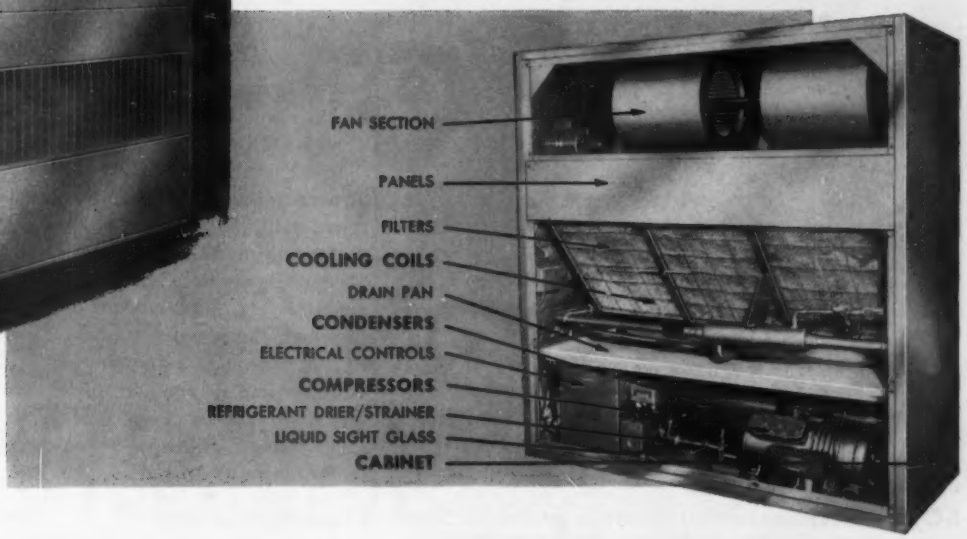

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R. Powell and Associates, mentioned that their approach to design problems is very academic.

"We run across this every time university professors here try to perform engineering services, but I do not think that we can stop this, nor am I entirely in agreement with the idea that university professors should not engage in consulting services. However, I do think that our various clients are better served by engineers in private practice than by university professors whose main source of income is from teaching, not research or design.

"As long as the professors do not use their positions to cut the standard fees of the locality, it is going to be hard to object to this practice. However, if they are going to do outside consulting, they should have an office and whatever other facilities they need away from the university. I believe that if the professors practicing engineering had to do their work in offices they set up and supported themselves, they would quickly realize the cost of doing business, and we would not be subject to unfair competition."

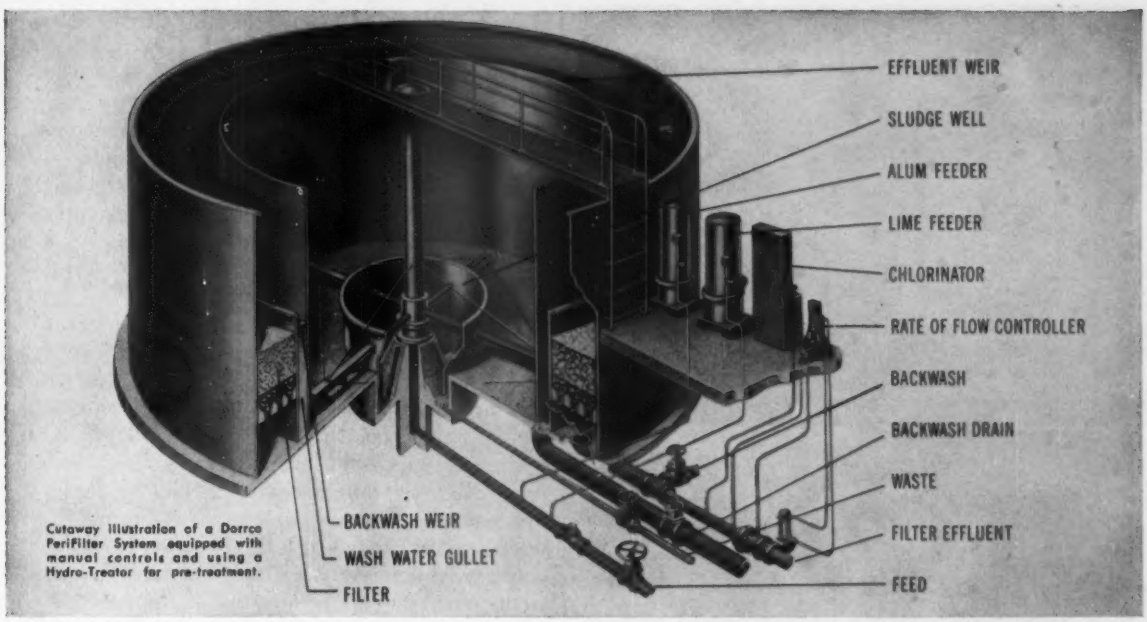
In further support of this viewpoint, D. C. Wolfe, of Sverdrup and Parcel Engineering Co., San Francisco, said, "Obviously, it is unfair to practicing engineers for a professor who has no overhead to accept engineering work to be performed by his students. Too, I have heard of at least one instance in which the client was sadly disappointed in the final results. Some engineering professors and instructors find it better to spend their vacation periods as employees of established engineering firms, thus perhaps obtaining a more realistic view of how such firms operate."

Feasibility Studies

Lee E. Ham, of Wilsey and Ham, Millbrae, California, reports that there appears to be an increasing number of engineering project studies being made by research or economic firms. These generally attempt to determine feasibility of a project, and two examples were cited. Will enough traffic be generated to retire revenue bonds for a highway? Based upon the economic growth of a community, how much water will it use? "Both of these examples," said Ham, "need top-flight engineering talent to determine the foundation on which to make the projections.

"These studies are further being offered as unbiased because the study firm does not do final designs and consequently does not have an incentive to exaggerate or warp an answer. This, I think, is ridiculous. No consulting engineering firm will continue in operation long with a history of repeatedly recommending and building unfeasible projects."

On the other hand, in practice, this actually works out just the other way around. Those associated



Cutaway illustration of a Dorrco PeriFilter System equipped with manual controls and using a Hydro-Treator for pre-treatment.

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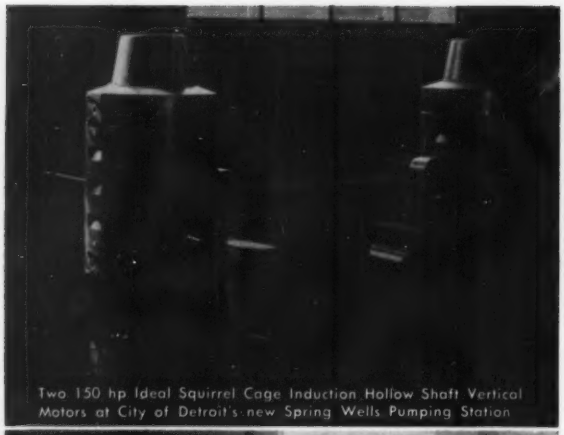

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with the research foundation, in making a report, realize that they have an opportunity to obtain repeat assignments or permanent employment with the company engaging them. They therefore may find it desirable to beam their report to what they think their client wants to hear rather than to an unbiased solution. Ultimate failure can be blamed not on the basic research but on the execution of the concept.

Engineering Societies Can Help

William W. Moore, of Dames and Moore, San Francisco, suggested that a continuous critical watch be kept on tax-free research institutes and moonlighting professors in order to keep their activities within proper bounds.

"In past years," said Moore, "there has been some very severe and improper competition by professors with the private engineers in California. To the best of my knowledge, this situation has greatly improved in recent years. This is not true in some of the other states. I believe that the present generally satisfactory circumstances in California have been the direct result of action on the part of engineering societies, which have approached the authorities of the universities with a rather forceful discussion of their problems.

"One of the basic needs is a clear statement defining the proper, acceptable, and ethical basis of operations for professor-consultants and tax-free institutions. As far as I know, there has been no clear statement of policy defining a proper line of demarkation for these activities. Probably this will have to be done before much progress can be made in reaching mutually acceptable ground rules for these practices."

William T. Wright, Los Angeles, reported that some years ago an investigation was made of research foundations by the Ethics Committee of the American Society of Civil Engineers' local chapter, but this particular investigation was inconclusive. "I wholeheartedly agree that there is certainly some doubt as to the ethical practices of certain research groups in the field of civil engineering. This particular matter currently is under investigation by the California State Board of Registration for Civil and Professional Engineers."

Frank E. Alderman, of Alderman and Swift, South Pasadena, and president of the Consulting Engineers Association of California, also pointed out, "It certainly is the concern of CEAC that these research groups claim to be unbiased because of certain nebulous connections with universities or because they are so-called nonprofit organizations. I think we would all be happy to be nonprofit organizations if we could set our salaries sufficiently high to make profits unnecessary." ▲▲

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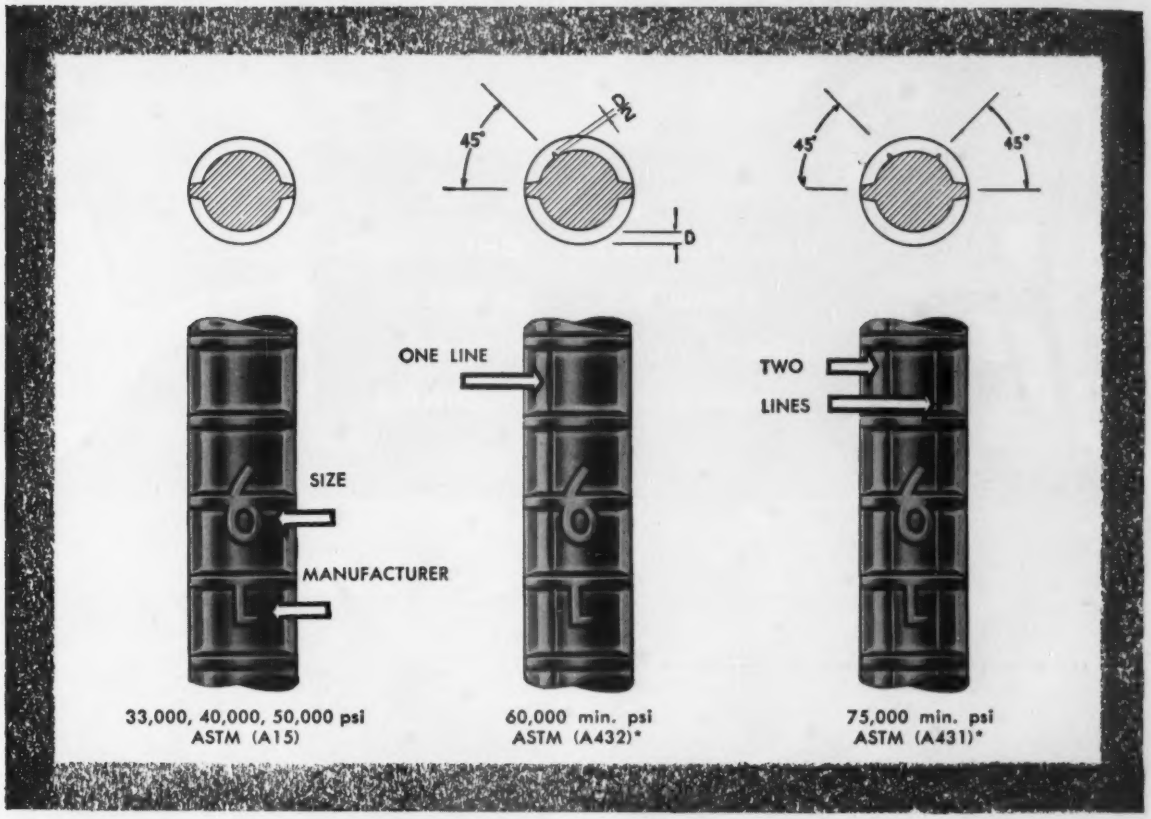

Standard high strength steels* permitting greater economy and efficiency in reinforced concrete design under the provisions of the new A.C.I. codes must be **identified.** Recognizing this need, each Laclede Multi-rib reinforcing bar can now be completely identified as to size, strength and origin through a new rolled-in marking system. This assures the designer, contractor, and code writer that the proper grade of reinforcement is used on the job.

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What Engineers and Architects Ask Us About Temperature Controls for Smaller Buildings

Q. Isn't it unusual to recommend pneumatic controls for the smaller installations? I always thought pneumatic controls were for the big jobs only.

A. Not at all. Johnson has always done work in buildings of all sizes. Naturally, you hear more about the big "name" jobs, but every year Johnson also furnishes pneumatic controls for thousands of small and medium size heating and air conditioning installations.

Q. To be practical, how small can a building be and still use a pneumatic control system?

A. Since building *size* has nothing to do with building *quality*, size isn't the problem at all. A quality-built *small* building needs just as good a control system as a first class *big* building. That means *pneumatic* controls if you want to give your clients big-system standards of comfort, efficiency and economy.

Q. What help does Johnson offer the engineer and the architect?

A. Johnson accepts complete responsibility for all control work. A Johnson engineer will plan a control system to meet your exact needs, no matter how small the job. His recommendations are backed by the Johnson organization's 74 years' experience with all types of systems and all makes of equipment. Likewise important, all installation work is done by Johnson's own full-time installation mechanics. There's no need for you to spend valuable time on planning, estimating, supervisory or installation details. Thus, Johnson helps simplify your work, saves your time and gives your client a top notch control system.

Q. What advantages does the owner get from pneumatic control systems?

A. They are much simpler and involve fewer components than other types. They require less supervision and are easier and less costly to maintain. Since each system is specially planned, they assure the greatest long range economy in the operation of heating and cooling systems. And, of course, nothing else combines the accuracy and dependability of pneumatic controls.

Q. Who does the owner look to for service when he uses pneumatic controls?

A. A good question and especially important to the smaller owner. Johnson backs its systems the way you wish all manufacturers could—by our own full-time, factory-trained mechanics, whose only job is the maintenance and repair of Johnson equipment. These men are stationed in over 200 cities. Nobody in industry gives better or more complete service than Johnson.

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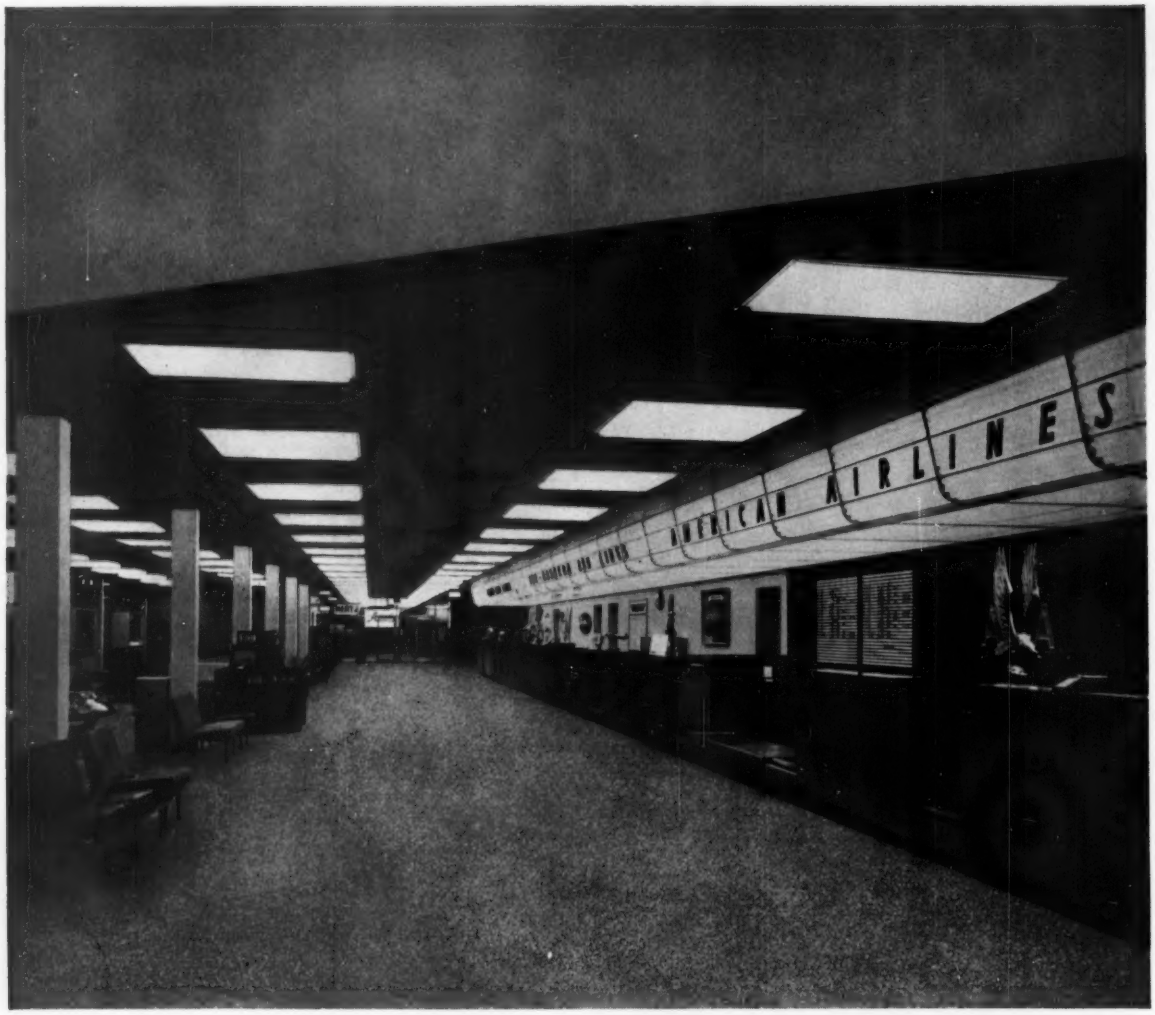

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Your National Certificate — What's It Worth?

The few engineers who have National Bureau Certificates of Registration find them increasingly valuable as passports to practice in other states.

As POINTED OUT by a delegate who was attending his first meeting in many years of the National Council of State Boards of Engineering Examiners, "I find that the same old questions and problems are still being discussed and debated." No one argued. Yet NCSBEE is doing more than just talk about improving reciprocal registration between states. It looks now as if it will become progressively easier for consulting engineers to work across state lines.

Currently, a Certificate of Qualification is an engineer's best passport to the licensing bodies of most states. These certificates are issued by the National Bureau of Engineering Registration, which is a permanent function of NCSBEE, created solely for this purpose of issuing certificates. But the Bureau often is confused with its parent body. Some engineers say they are certified by the National Bureau, others by the National Council.

Clarification Offered

T. Keith Legare, who has been "Mr. Registration" for years, points out that the Certificates of Qualification issued through the National Bureau of Engineering Registration are signed by the executive secretary for the National Council, and the official seal of NCSBEE is embossed on every photocopy of a Certificate that is issued. (Legare, who retires next month, is a past president of NCSBEE and has served as executive secretary of both this group and the National Bureau for many years. His duties included processing Certificates.)

Only 2360 persons hold Certificates of Qualification, and requirements for the national endorsement of an engineer's qualifications gradually have become more restrictive. Newell Freeman, secretary of the New York State Board of Examiners, explains it this way. "There is less chance of an unworthy or submarginal candidate obtaining a national certificate than of obtaining a state certificate because the minimum standards for a Certificate of Qualification are above the minimum standards set up in the Model Law. At least five registered engineers must give favorable testimony for an applicant, and no candidate will be considered for a Certificate unless he is already registered in his home state."

Two years ago, minimum qualifications for certification were increased. A candidate, who has become registered by written examination in his home state, now must be 30 years of age (previously 27) with 12 (formerly 10) years of experience. An applicant who qualifies through practice must be at least 40 years old (previously 35) and have 20 (formerly 15) years of experience. "We also are taking a closer look at experience records than we once did," Legare added.

A Certificate of Qualification still does not guarantee that an engineer can become registered in any state without a test. As the NCSBEE constitution points out, "Certification by the Registration Bureau is not a prerequisite for registration in any state, nor is it binding upon the State Boards of Registration, and they reserve the right to take whatever action they deem necessary to conform with their laws and regulations in connection with any application for registration in their states."

Yet, as immediate past president William H. Larkin pointed out at a meeting several years ago, ". . . there are 53 separate and distinct license or registration laws in this country. Many are similar, some are new, many are older and hence more mature . . . it is the expressed desire, we believe, of all boards that a candidate not be examined more than once in a given area (or specialty) providing the grades attained are satisfactory."

Many states accept the Certificates without question and issue a license to the certified applicant with no further question. Only Alaska, California, and Washington answer with a flat "No" when

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ATLAS MINERAL

MERTZTOWN, PENNSYLVANIA

asked if they grant licenses on the basis of Certificates. The remainder of the states reply with a qualified or a flat "Yes." Most frequent qualifying statement is one requiring written examinations, still an area of contention among some state boards. Most consider oral tests inadequate.

"Eminence" Problem

Another disagreement among state boards is the definition of "eminence." Criteria, suggested by an NCSBEE committee, are:

¶ Demonstrated adherence to high ethical standards.

¶ Demonstrated integrity in the practice of the profession.

¶ Outstanding ability which might be established by examination of his record as follows:

a. Responsibility given candidate by his company.
b. Contributions that have been made to technical literature.
c. Work performed while serving on technical committees.
d. Patents.

¶ Interest in his profession:

a. Membership in the technical societies.
b. Membership in professional societies.
c. Work on education committees such as college visiting committees, etc.

Within recent years, international reciprocity has become a matter of concern – particularly in states bordering Canada. Only Michigan has taken legislative notice of this problem. Other states do not prohibit recognition of foreign registration; they leave it to the discretion of the board. According to NCSBEE minutes:

"The question of international reciprocity has been proposed by several state boards. It is the opinion of this Committee (on Uniform Laws) that it can easily be accomplished by a slight change in a state law. Michigan has provided for it in Section 20 of their law which states that a registrant of another state or territory or possession of the United States, or any country, can be registered, provided that his requirements do not conflict with the provisions of the act and are not lower than specified therein, and also provided that equal privileges are granted by the other country."

The problem of reciprocal registration between the United States and Canada is most acute in the northeastern border states. Quebec has the most restrictive regulations in Canada (requiring five years residence before application can be made for registration. This usually is circumvented by taking a Quebec engineer as partner on the project.) Some of the northeastern states have retaliated on an eye-for-an-eye basis – reciprocity in its purest though hardly in its most professional form. Three years ago, NCSBEE and the Canadian Council for Professional Engineers formed a committee to see what can be done.

Legare said no comparable problem ever has arisen in states bordering Mexico, probably because Mexico has few consulting firms, or firms with engineering staffs, that want to work in the U. S.

The Model Law is perhaps one of the better known paths to improving reciprocal registration among states. The Model Law is intended to be used as a guide in the preparation of legislation that will provide uniform methods and procedures for the registration of engineers. Uniformity of a high standard is the ultimate aim.

For more than a year, NCSBEE has been working out the details of the revised Model Law with its advisory committee (which includes representatives from the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the American Society of Engineering Education, the American Institute of Chemical Engineers, the National Society of Professional Engineers, the American Associa-

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Edison Lanes, Edison Township, N. J. Chrysler Air Conditioning Contractor: Nicholas W. Schwalje, Inc., Metuchen, N. J.

World's largest bowling lanes cooled by Chrysler Packaged Air Conditioning

Almost a quarter of a mile separates Lane No. 1 from Lane No. 112 at Edison Lanes, Edison Township, N. J. If a bowler ever made the trek, then Chrysler Packaged Air Conditioning units would be keeping him cool and comfortable every step of the way.

It takes 340 tons of air conditioning to cool bowlers behind the foul lines and in the service areas. Since it is not necessary to cool the lanes themselves, the diffusers and air returns are concentrated at the foul lines to create a "curtain wall" effect. This prevents cool air from spilling out of the conditioned areas.

The 20- and 30-ton Chrysler Air Conditioners are self-contained evaporative condenser units with dual compressors. They're specially arranged to provide zone control, so only the lanes in use need be cooled.

Chrysler equipment was selected for this job because it offered the owners the twin advantages of flexible installation and most economical operation. For more information, or the technical cooperation of a Chrysler air conditioning engineer, write today.

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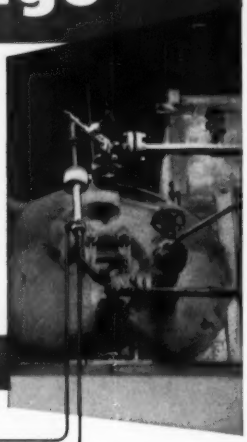
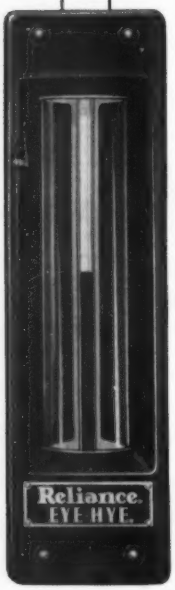
Why a remote reading gage

- Most boiler drums are high — direct gages are far from operating floor.
- Obstructions often make gages hard to see — necessitate special equipment or frequent climbing to inspect.
- Remote gage saves thousands of steps, hours of valuable time. Brings gage reading *down to eye level* at safe distance from boilers.





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- EYE-HYE assures perfect measurement, dependability and clear reading.
- All-hydrostatic principle — no mechanical parts — no adjustments on location.
- Reads in liquid, like a conventional gage, but easier, faster because of illuminated green indicating fluid.
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- Economical special attachment actuates supplementary alarms, audible or visible, if desired.

- Available for either wall or panel mounting, new wide-visibility EYE-HYEs are made for any pressure range — up to 3000 psi. Also long window model for unusual liquid level variation — for tanks, heaters, etc.

Write for catalog information on EYE-HYE for *your* boiler pressure.

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Reliance BOILER SAFETY DEVICES

tion of Engineers, the American Railway Engineering Association, and an important newcomer, the Consulting Engineers Council). The final draft is to be presented at the annual NCSBEE meeting in Portland, Oregon, August 18-20.

An almost equally important step by NCSBEE toward improved reciprocity agreements, but much less known, is the standard examination worked out in at least three of the Council's four zones. In the Northeast Zone, which includes 13 states, uniform examinations for registration were agreed upon six years ago. All 13 states have endorsed the test, which was compiled from questions contributed by prominent engineers residing in the area. However, only six of the states actually use the test. The remainder, with New York as an example, have so many registration applicants that it is impossible to participate in joint tests because of scheduling difficulties. But among the states using the standard test, reciprocal registration is almost automatic.

The Southern Zone has endorsed a similar plan but on a different level. In an experimental program, common EIT exams were given by North Carolina, Alabama, and Louisiana. "We hope to continue this movement and to have the examinations processed at some central place, to assure uniform grading," Zone officers reported. Legare said the Central Zone also has plans for some sort of common examination for registrants, but he has heard of no movement in the Western Zone.

Oddly enough, "reciprocal registration" is considered a misnomer by many. As Larkin explained:

"This procedure of granting registration in one state on the basis of examinations taken and passed in other states has been called registration by comity, or reciprocity, or endorsement.

"Comity is the extension of a privilege, as a simple courtesy, and is not based upon any specific

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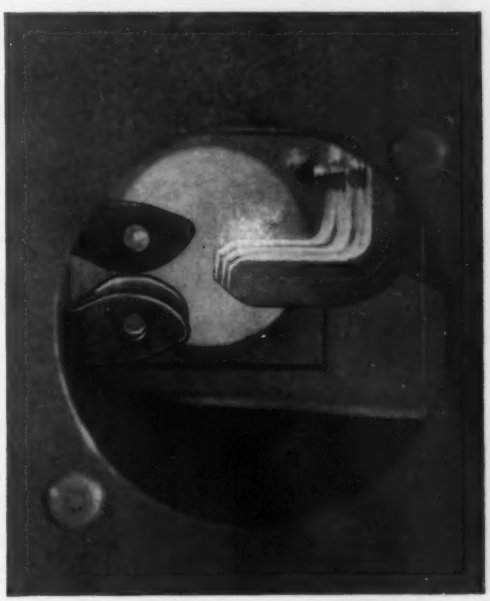

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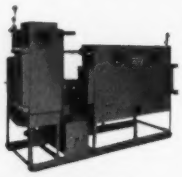
NEW DURABLE KATHABAR® SYSTEMS

offer high performance with new low maintenance for years of troublefree service



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Consulting engineers like the Kathabar system: no re-heat, no frost, no chemical carryover. Humidity, independent of dry bulb, controlled with no reversing or interruption for regeneration.

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agreement or understanding. It is clear that the wide variations in the several license laws make it impossible to apply the rule of comity except in isolated cases . . . and comity is not a term we can recommend for general use.

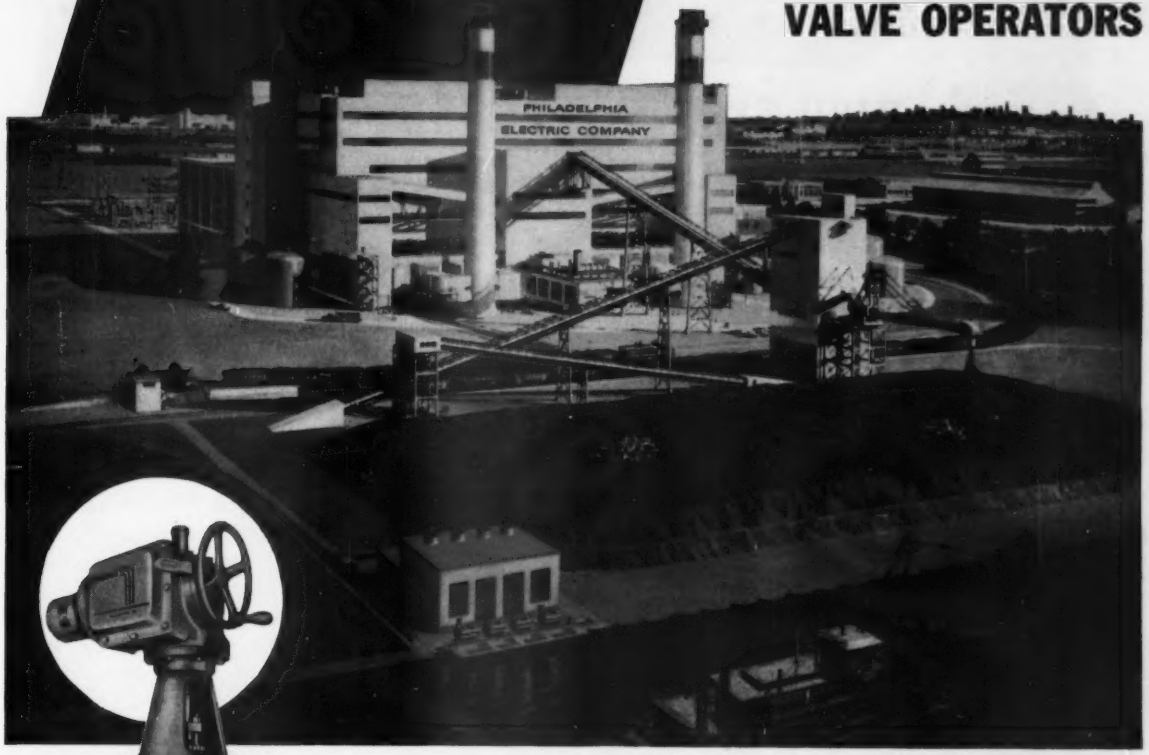
"Few state boards reported registration of out-of-state candidates on the basis of reciprocal agreements last year. These agreements may be written or verbal and may be terminated by either party at will. Dissimilar standards place one of the boards in the position of granting to out-of-state applicants privileges it cannot grant to its own citizens. It would appear that 'reciprocal' is not the term we are seeking.

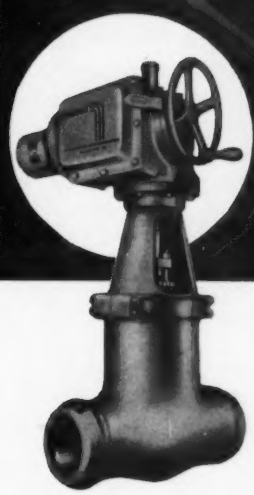
"A board considering an out-of-state applicant, and with full data before it regarding examinations passed and grades obtained elsewhere, can approve or endorse the basis upon which he was licensed originally. It can then license him forthwith. This procedure can well be called licensure by endorsement, and it is the opinion of this committee that where interstate registration is granted on the basis of a full and complete record, the proper term to use is 'by endorsement,' as used in New York State."

In addition to the problems of granting licenses, reciprocal or otherwise, registration boards are facing an increasingly serious problem – where to find the money on which to operate. Although all state registration boards are more than self-sustaining because of fees charged registrants, many state laws require that any money collected be placed into the state's general fund. In turn, the legislature appropriates operating funds for the registration board.

An extreme example of what can happen is illustrated by the present situation in Delaware. Last year, the legislature gave the Delaware registration board no funds whatsoever, and the board closed down operations last January. The Massachusetts board also is re-

New Eddystone Station of PHILADELPHIA ELECTRIC CO..... uses LimiTorque VALVE OPERATORS





This Generating Station is one of the World's most efficient power plants . . . consisting of two 325,000 K.W. Super-critical Pressure Units.

LimiTorque Motorized Valve Operators were chosen for various steam and water applications throughout the Plant. It is significant that LimiTorque is also used in the other Generating Plants of the Philadelphia Electric Company . . . In fact, practically all of the modern generating stations in America use LimiTorque Valve Operators for assurance of dependability, accuracy, safety and economy of operation.

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Again Layne & Bowler sets new standards of quality construction for the pump industry... *longer-life Molybdenum-Iron is now "standard" construction — at no extra cost — in* ALL *"Verti-Line" pump cases and other cast iron parts!*

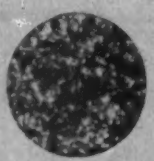
"Moly" iron has a more uniform grain structure, is far more corrosion-resistant than is the gray iron normally used in pump construction. Therefore, you get longer operating life, lower maintenance costs, when you specify Layne & Bowler "Verti-Line" Pumps!

COMPARE!

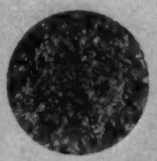
GREY IRON

MOLY IRON

▶ **These Photomicrographs,** both made at exactly the same enlargement (100x), show the structure of gray iron (left) vs. "Moly" iron (right). Note the long "stringers" of soft graphite characteristic of gray iron — stringers that weaken the metal and lead to early breakdown of the iron matrix. Note (right) how "Moly" iron is far more homogeneous, with uniform distribution of the iron matrix for longer pump life.



GREY IRON



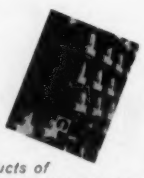
MOLY IRON

▶ **These "Fractures"** (views across fractured surfaces) clearly show the much coarser grain of gray iron (left) vs. the uniformly fine grain of "Moly" iron (right.) Although Layne & Bowler's fine-grained "Moly" iron assures much longer pump life than the gray iron used in other pumps, *you now pay nothing extra for this important "Verti-Line" advantage!*

Layne & Bowler has its own modern foundry—therefore can standardize its foundry runs to "Moly" iron techniques *at no extra cost to you.*

And if your operations are extra tough, "Verti-Line" pumps are available in special "Moly" irons having a Brinell as high as 350... a Tensile as high as 50,000 psi!

Remember — "Moly" iron is just one of many major pump advancements built into every "Verti-Line" pump — advancements that assure top performance for your pump dollar when you specify "Verti-Line" Pumps!



For more details on the many "Verti-Line" advantages, write for Bulletin #200.

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ported to be down to stamp money for the same reason. What happens to a Delaware resident who wants to become registered? He must wait until next year and hope that the State Appropriations Committee and the legislature have a change of heart in the meantime.

Could this happen to your state? It could if you live in Alabama, California, Connecticut, Delaware, the District of Columbia, Georgia, Illinois, Indiana, Massachusetts, Michigan, Missouri, New Jersey, New Mexico, New York, Oregon, Pennsylvania, Puerto Rico, Rhode Island, South Dakota, Tennessee, Texas, Utah, Virginia, Washington, or West Virginia. Other state boards control their own finances to varying degrees.

For consultants planning to apply for licenses in other states, here is the latest scoreboard, by NCSBEE, on who gets reciprocity (or endorsement). Although the question was, "To whom do you grant reciprocity?", the answers sometimes strayed a bit.

Alabama — all states, provided requirements are not lower.
Alaska — on equal basis.
Arizona — complete application, qualify under law.
Arkansas — qualifications not less than our minimum at the time of the previous registration.
California — the applicant may be given 45-minute to three hour individual examination.
Canal Zone — not automatic, depending on individual case.
Colorado — granted only on basis of eminence clause.
Connecticut — if prior registration not lower in standards.
Delaware — decided on merits.
District of Columbia — discretion of Board.
Florida — must have met same requirements as Floridan.
Georgia — previous registration under same or higher requirements.
Hawaii — equivalent but including written examination.
Idaho — on merits, must meet the minimum requirements of our Law.

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The PERFECLITE "PHAROS"

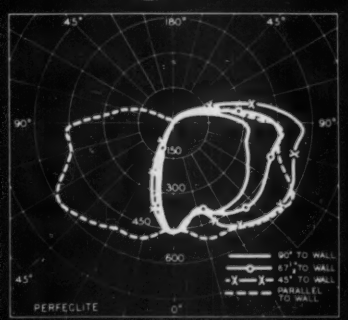
A Totally New Concept In Controlled Exterior Illumination

Another first from Perfeclite! A modular shaped lighting fixture that completely outmodes the usual exterior bracket extending on a heavy arm from the wall.

Ultra-modern in design, the new Pharos gives an asymmetric light pattern . . . provides high intensity illumination for wall areas . . . disperses a powerful outward distribution of light 90° from the wall as well. The heat-resistant glass refractor uses accurately calculated prisms on seven transmission surfaces . . . incorporates a silvered glass reflector at the top which directs the light downward.

Made of cast aluminum, gasketed and weatherproofed, the Pharos opens on concealed hinges for easy relamping, easy maintenance. It is rated at 200 watts, utilizing a standard A-25 lamp.

For further information, mail the attached coupon today!



CANDLEPOWER DISTRIBUTION
200 W. A-25 I. F. LAMP
E. T. L. REPORT NO. 372483

Units are Underwriters' Laboratories Inc. approved.

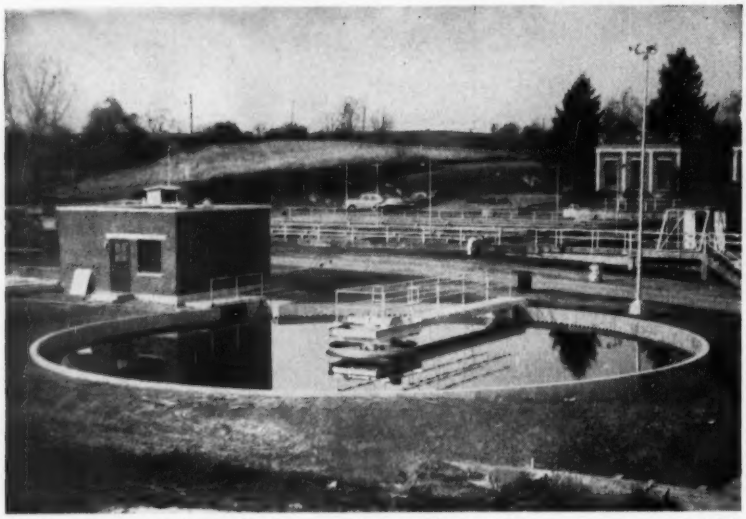
THE PERFECLITE COMPANY
1457 East 40th Street **Cleveland 3, Ohio**

Please send me the Perfeclite Data Folder 59-C.

NAME _____

ADDRESS _____

CITY _____ **STATE** _____



Hardinge Center-Column Clarifier recently installed at the Hagerstown Sewage Plant

another HARDINGE Clarifier for HAGERSTOWN

Original installation: Two Hardinge Rotary Clarifier Mechanisms in rectangular tanks.

Second installation: A Hardinge Primary Clarifier doing heavy duty.

- *1932*—The City of Hagerstown, Maryland, installed its first Hardinge equipment in their sewage treatment plant—two 50' x 12' rotary mechanisms for final clarification.
- *1949*—The City of Hagerstown, installed a 55' diameter Hardinge circular beam-type primary clarifier for raw screened sewage in their disposal plant—H. E. Rhodes, Superintendent.
- *1958*—The City of Hagerstown installed the 60' diameter Hardinge center-column circular clarifier pictured above, for additional final clarification in their activated sludge plant—J. L. Eyerly, Superintendent.
- *Today*—The Hagerstown Sewage Plant is now processing an average of six million gallons of sewage daily with Hardinge units, old and new alike, in full operation.

HARDINGE
COMPANY, INCORPORATED

YORK, PENNSYLVANIA • 240 ARCH ST. • Main Office and Works
New York • Toronto • Chicago • Hibbing • Houston • Salt Lake City • San Francisco • Birmingham • Lakeland

Illinois – equal requirements at time of first registration.
Indiana – if registered by means not lower than those that are specified in our Act.
Iowa – if qualified originally by a written examination.
Kansas – satisfy minimum requirements of Law.
Kentucky – yes, if by education and experience or 16-hour written examination.
Louisiana – previous registration meets requirements of Act.
Maine – same conditions.
Maryland – applicant's qualifications are equivalent to State Law.
Massachusetts – if the minimum requirements of other states in which registered are equal.
Michigan – qualifications equal to the requirements of our State Law.
Minnesota – equal qualifications at time of first registration.
Mississippi – obtain primary evidence from school and board.
Missouri – recognized on official certificate of written examination from another registration board.
Montana – recognize, check the qualifications with other State.
Nebraska – same standards.
Nevada – all applicants appear at Board meeting for oral review.
New Hampshire – review the registration methods of the other states. Possible examination.
New Jersey – none.
New Mexico – if law is equivalent.
New York – eligibility for the New York State examination. Already passed full equivalent.
North Carolina – required application form and satisfactory references, plus examination if not registered with examination. Absolute reciprocity on examination basis (i.e., honors all written tests given by other states).
North Dakota – equal standards.
Ohio – equal to Ohio requirements at time of registration.
Oklahoma – states which have agreements with Oklahoma (eight of them).
Oregon – if he qualifies under law, reciprocity is granted to applicant.

Read what an erector has to say about

HIGH STRENGTH BEARING BOLTS!

(Company name on request)

"Our company had the erection contract for six steel mill buildings in Beaver Valley. The owner was interested in using High Strength Bearing Bolts in two of their buildings, because of the rigidity and stability they promised to provide for buildings subject to heavy service use. L & S was contacted on price and delivery, and on finding the new bolts cost no more and were available, they authorized their use.

AT BEAVER VALLEY, PENNSYLVANIA

One of two recently completed steel mill buildings using High Strength Bearing Bolts for all bolted connections.

"We found that the bolts were installed with a minimum of difficulty. Our bolt-up crews had had no previous experience with the Bearing Bolt. All of the men had worked with Dardelet, High Strength and machine bolts. After the first few hours they found they were installing the new bolt much faster than Dardelet and in a majority of the connections about as fast as for High Strength Bolts.

"We used the same tools that were used for High Strength Bolts. The men were able to work independently from one another while making hand assembly of the truss connections on the ground. It was not necessary to hold the head of the bolt while snugging the nut as is the case for High Strength Bolts. Thus better distribution of labor was possible. Nuts were snugged up by hand and were later torqued in the air to eliminate any question about which bolts were tight.

"Trusses were stable and were lifted into position with a single sling at the truss apex. It was also found that they were straight and true, and aligning the bottom chord with truss bracing was simplified. Savings developed in crane walkway plate connections where one man was free to insert the next bolt ahead of the impact man once a bolt had been placed in the hole, and washer and nut were added.

"The crews were able to proceed in the same manner as for assembly of High Strength Bolts at other connection points, such as bracing, crane girders and the like.

"The owner had offered to pay the difference between the cost for installing the new bolts as compared to High Strength Bolts. There was no additional charge for this installation."

5 BASIC FACTS ABOUT HIGH STRENGTH BEARING BOLTS

1. High Strength Bearing Bolts combine the tensile strength of a High Strength Bolt with the bearing of rivets.

2. High Strength Bearing Bolts have the highest shear strength and greatest resistance to slip of all structural fasteners.

3. High Strength Bearing Bolts make possible important labor savings in fabrication and erection.

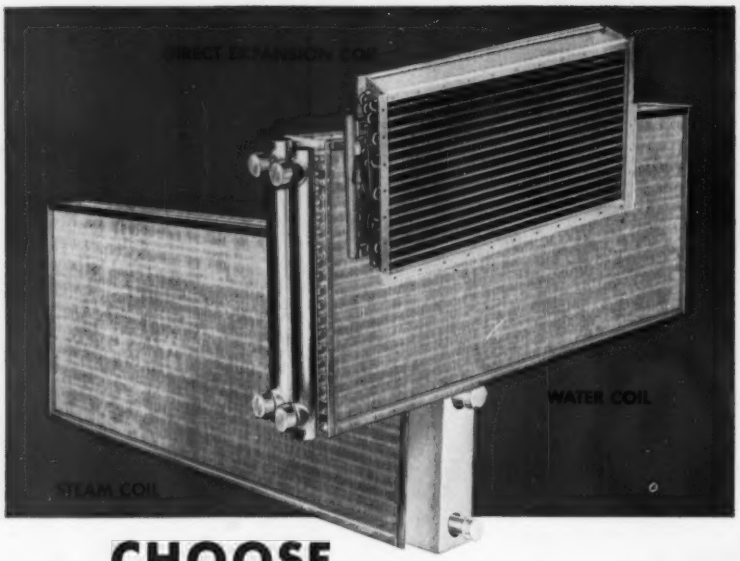
4. The High Strength Bearing Bolt assembly (bolt, nut and one washer) costs no more, grip for grip, than a High Strength Bolt assembly (bolt, nut, two washers).

5. High Strength Bearing Bolts (and Lamson High Strength Bolts) are available from all the Steel Service Centers of U. S. S. Supply Division, United States Steel Corporation. Contact L & S, or any U. S. S. Supply Division Steel Service Center for details.

LAMSON & SESSIONS

5000 TIEDEMAN ROAD • CLEVELAND 9, OHIO

Plants in Cleveland and Kent, Ohio • Chicago and Birmingham



CHOOSE BOHN KNOWN-CAPACITY COILS

ALL BOHN COILS are ruggedly built...

- Die-formed plate-type aluminum fins... from 4 to 14 per inch...with self-spacing collars completely covering the tubes. Permanent, tight, metal-to-metal fin-tube bond.
- Heavy-gauge casings die-formed from galvanized steel.
- Headers of heavy-wall seamless copper tube with heavy die-formed end caps. High pressure tested at 320 psig. minimum air pressure under warm water.
- Tested and rated according to ASRE-ASHAE standard 33-58.

IN ADDITION...

DIRECT EXPANSION COIL — Type DE, insures equal distribution of refrigerant with brass pressure-type distributors;

WATER COIL — in Types WH, WF, and WD, is drainable in every type;

STEAM COIL — in Types S, NFS, and NFO, has condensing tubes pitched in casing a minimum of ⅛" per foot of tube length, as well as orificed steam supply tubes, and coil tubes floating free within coil casing to prevent stress and strain on tubes and joints... maximum operating pressure 200 psig. at 400° F.

We have some territories still open for Manufacturers Representatives who are active in the heating and air conditioning fields. Write today to Sales Manager, Heating and Cooling Coil Department, at the address below.

BOHN *Buy the known line... the BOHN line*

Aluminum & Brass Corporation

Danville Division • Danville, Illinois

Pennsylvania – if registration is by written examination.

Puerto Rico – must be ECPD school, four years' experience, and written examination.

Rhode Island – application reviewed, if by examinations, depends on which states.

South Carolina – granted if applicant has satisfactory qualifications.

Tennessee – each case considered on its merits.

Texas – requirements not less than those of the State of Texas.

Utah – when qualifications meet Utah standards.

Vermont – if registration under equivalent to our requirements.

Virginia – oral examination if applicant did not obtain registration by written examination.

Washington – qualifications equal.

West Virginia – if previously registered by an examination that is of equal quality.

Wisconsin –equal to or exceeding requirements on date filed.

Wyoming – reciprocal license is granted to those previously licensed by examination.

Anyone holding a Certificate of Qualification from the National Bureau will be recognized as qualified for registration without further evidence in Alabama, Arizona, Canal Zone, Connecticut, Delaware, District of Columbia, Georgia, Hawaii, Indiana, Iowa, Kansas, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Montana, New Hampshire, New Jersey, New Mexico, New York, North Dakota, Ohio, Oklahoma, Oregon, Puerto Rico, Rhode Island, South Carolina, South Dakota, Tennessee, Wisconsin, and Wyoming.

Several other states, while not required to do so by law, do accept the National Certificate as indication of qualification, especially if the Certificate was secured through examination. Any engineer interested should contact the engineering registration board of the state in which he desires reciprocal registration. ▲▲

EVERY 3-YEAR-OLD KNOWS...

what some transformer manufacturers have forgotten

Before he could talk, Junior learned that *resiliency absorbs shock*—that a marble dropped on the floor makes more noise than one dropped on a pillow. Elementary? You'd be surprised how many transformer manufacturers forget this simple fact when they design a cabinet model. Or maybe you wouldn't be surprised—maybe you've heard some of them roaring away.

On every JEFFERSON dry type cabinet transformer the core and coil are *completely isolated* from the cabinet—floating on a resilient cushion of rubber—minimizing vibration and sound. JEFFERSON gives you the quiet operation that is always desirable, and necessary in hospitals, libraries, offices and schools.

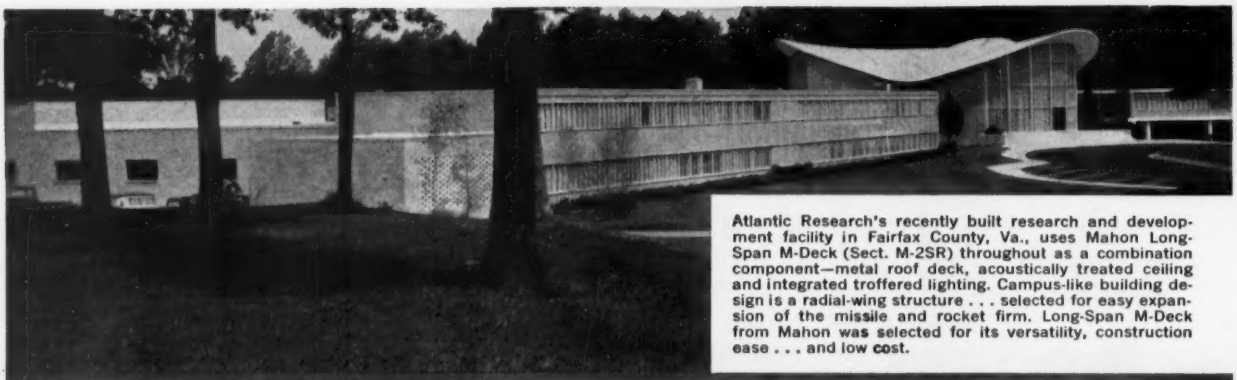
They're designed to last longer, too. JEFFERSON engineers have provided plenty of wiring space by mounting core and coil *above* the base so that wiring is never exposed to higher than ambient temperatures. JEFFERSON insistence on quality is reflected by the fact that every cabinet must have three coats of paint—every bolt must be plated—a reassuring fact when your transformer must perform under humid conditions.

These are just a few examples of the expert engineering that has made JEFFERSON transformers the preferred line.

Cabinet Models available in:
Single Phase—25KVA through 100KVA
Three Phase—112.5KVA through 300KVA

Jefferson *DRY TYPE* TRANSFORMERS

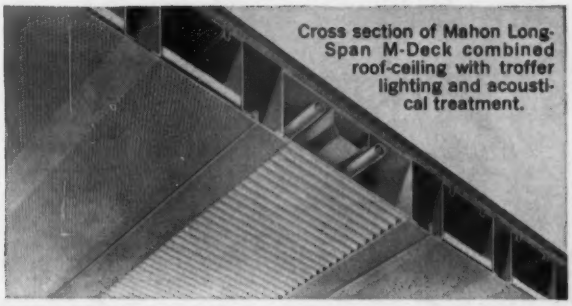
Jefferson Electric Company • Bellwood, Illinois



Atlantic Research's recently built research and development facility in Fairfax County, Va., uses Mahon Long-Span M-Deck (Sect. M-2SR) throughout as a combination component—metal roof deck, acoustically treated ceiling and integrated troffered lighting. Campus-like building design is a radial-wing structure . . . selected for easy expansion of the missile and rocket firm. Long-Span M-Deck from Mahon was selected for its versatility, construction ease . . . and low cost.

MAHON MULTI-USE LONG-SPAN M-DECKS

Interior view of one of Atlantic Research's engineering sections showing ceiling side of Mahon Long-Span M-Deck —attractive, functional and noise proofed. Troffer lighting M-Deck sections harmonize with surroundings—provide diffused, glare-free illumination.



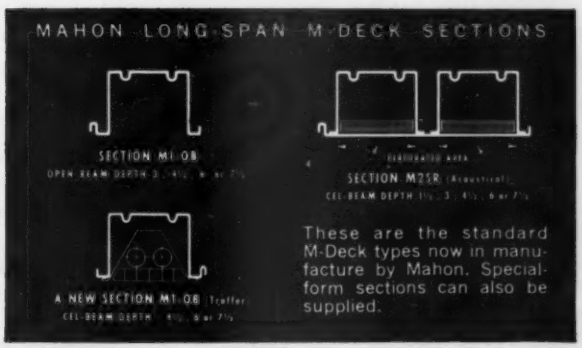
Cross section of Mahon Long-Span M-Deck combined roof-ceiling with troffer lighting and acoustical treatment.

Today, more than ever, architects and engineers are depending on Mahon Long-Span M-Decks as proven, multi-purpose roof sections that provide a combined structural roof deck and ceiling. Now, for less cost than once required for conventional steel roof systems, you can also specify functional ceilings that fit into almost any job.

short-cuts to quality construction —long strides toward cost reduction

These steel sections give you more design and construction advantages . . . (1) adaptability: serving as structural members, roof decks, finished ceiling material—even acoustical treatment; (2) efficiency: high strength-to-weight ratio permits spans from wall-to-wall or truss-to-truss . . . roof beams and purlins can be eliminated; (3) economy: easy handling, fast erection, rapid covering—saving time, labor and material; and (4) flexibility: producing either flat or beamed ceiling surfaces with or without recessed troffer lighting or acoustical treatment, in metal gages and gage combinations to suit your need.

Find out what quality-made Mahon Long-Span M-Decks can do for you . . . your work . . . your costs by talking with your local Mahon architectural representative, consult Sweet's Files or write for information Catalog LSD-60.


MAHON LONG-SPAN M-DECK SECTIONS
SECTION M1-OB
SECTION M2SR
A NEW SECTION M1-OB
These are the standard M-Deck types now in manufacture by Mahon. Special-form sections can also be supplied.

MAHON BUILDING PRODUCTS

- Aluminum or Steel Curtain Walls (in natural or colored metals)
- Rolling Steel Doors (Standard or Underwriters' labeled)
- Metalclad Fire Walls (Underwriters' rated)
- M-Floors (Steel Cellular Sub-Floors)
- Long Span M-Deck (Cellular or Open Beam)
- Steel Roof Deck
- Acoustical and Troffer Forms
- Acoustical Metal Walls, Partitions and Roof Decks
- Permanent Concrete Floor Forms

CONSTRUCTION SERVICES

- Structural Steel-Fabrication and Erection
- Steel Fabrication-Weldments

THE R. C. MAHON COMPANY
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Manufacturing Plants—Detroit, Michigan and Los Angeles, California

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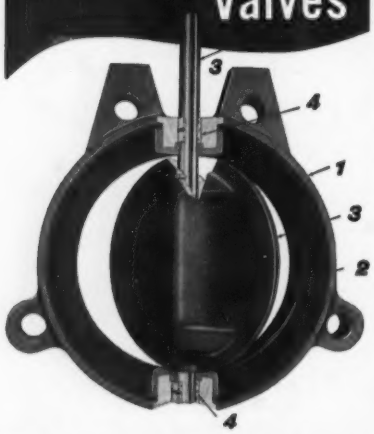
SPEEDING AMERICAN CONSTRUCTION WITH METAL BUILDING PRODUCTS, FABRICATED EQUIPMENT AND ERECTION SERVICES

MAHON

PACKED with COMPETITIVE ADVANTAGES

ROCKWELL Resilient-Seated Butterfly Valves



1 Less weight, space and cost: Valve face-to-face, overall height and weight are one-fourth to one-eighth those of gate valves. Cost less initially and are easier to install.

2 Drop-tight, leakproof closure. Resilient elastomer liner forms positive seal with disc. Liner removable on the job.

3 Disc and shaft assembly designed for highest rated pressure under most severe operating conditions; always operable manually or automatically.

4 True close bearing fit for shaft; non-leaking, non-galling, corrosion-resistant.

5 And what is quite obvious: the streamlined, self-cleaning design that eliminates cavities and voids in body; low pressure drop; no fouling. Valve can be installed in any position.

Bulletin 590X gives all the powerful facts. Write for a copy.

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Scraps & Shavings

Sewer District Lauds Consultants

The Metropolitan St. Louis Sewer District has warmly commended a group of consulting engineers, subdividers, and a soils expert for outstanding work and a high degree of public service in helping to develop a new set of storm water criteria. These were put into effect by the MSD on January 4, 1960. Participating consulting engineers were Henry Reitz, Fred Helmkampf, and Stifel Jens.

Corps of Engineers Cutback

Layoffs for engineers, draftsmen, inspectors, and other such civilian personnel will hit the Corps of Engineers in the South Pacific and North Atlantic Divisions, as well as several others. Main reason is a heavy cutback in Army and Air Force construction. California's governor has protested because of his state's current interest in water resources development.

ASTRA Gets Nuclear Contract

ASTRA, the first tenant of North Carolina's Raleigh-Durham-Chapel Hill Research Triangle, has been retained as nuclear consultant for the Carolinas Virginia Nuclear Power Associates. Composed of four southern power companies, CVNPA was formed in 1956, filed the Parr plant proposal with the Atomic Energy Commission in 1957, and reached a basis of agreement with AEC in 1958. Preliminary work at the power site, located on the Broad River, has been under way for some months. Reactor designer for the project is Westinghouse Electric Corporation, and Stone & Webster Engineering Corporation is the construction agent.

Parking Fee Computer

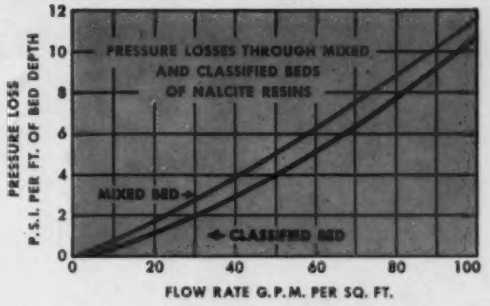
A new 703-car underground parking garage is now in operation at the Brooklyn Civic Center, with an automatic electronic fee computing device. All data pertaining to vehicle and revenue totals is printed continuously and totaled hourly on a remote recorder located in the parking garage manager's office. Drivers receive a punched ticket upon entering the parking area and present it to an attendant on leaving. The attendant inserts the ticket into the fee computer which flashes the correct fee on an indicator. The remote recorder makes a complete record of vehicles in, vehicles out, time, receipts, and attendant identification.

Kansas City Parking

A proposal calling for a 1000- to 1200-car parking garage over Main Street and atop several buildings has been presented to the Kansas City, Missouri, City Council by the consulting engineering firm of Howard, Needles, Tammen & Bergendoff. The plan, prepared voluntarily by the engineering firm, would require condemnation proceedings by the city. It calls for financing of about $4 million

How to Make Your Demineralizers GROW: Replace Worn-out Resins with New Nalcite® Ion Exchangers

Added Capacity Teams With Higher Flow Rates, Less Pressure Drop, To Increase Demineralized Water Output at Low Cost



Demineralizers are like storage space—you can always use more capacity . . . And new Nalcite resins can help you get that added capacity from your present demineralizer installation.

"Better than new" is a practical prospect with Nalcite resins. They not only outperform older Nalcite ion exchange materials (which were as good as could be made at the time), but they also have longer useful life.

New Nalcite Resins Stay New

Nalcite HCR-W* cation and Nalcite SBR-P* anion exchangers were designed to eliminate the enemies of ion exchanger performance: strong resistance to bead breakage and loss, and organic fouling, keeps capacities up, resin addition down.

Nalcite SBR-P Anion Exchange resin has taken a leading place in the water demineralization field since its introduction in 1957. It is a strongly-basic anion exchanger with both high porosity and high capacity. While it is especially suited for waters containing organic matter and color, its high capacity and efficiency are good reasons to consider it as replacement for worn out type 2 as well as type 1 resins. It can be used effectively on all types of water supplies. Brine washing to remove organic matter and color has been eliminated in several demineralizers now using Nalcite SBR-P in place of older type resins. Excellent particle size characteristics add to the efficiency of Nalcite SBR-P. Optimum bead size facilitates foreign matter removal, minimizes expansion during backwash, and permits use of less freeboard in many installations. High flow rate mixed bed demineralization and applications which subject resin to considerable physical handling are other areas where Nalcite SBR-P has proved an outstanding performer.

Nalcite HCR-W* Cation Exchange resin has the high degree of sphericity and very narrow range of particle size distribution that assure low operating pressure losses in both mixed and classified bed demineralizers. Virtually stress-free HCR-W spheres reduce breakage due to regeneration, high flow rates or other causes—including drying. Nalcite HCR-W beads also resist channeling and packing. Nalcite HCR-W has excellent physical and chemical stability under most severe demineralizer operating conditions, plus high exchange capacity to make your demineralizers grow in efficiency for you.

Replace All or Part of Resin?

Replacement of entire beds with Nalcite SBR-P and HCR-W is the way to boost demineralizer performance and capacities to top efficiency. Partial bed replacement may be made with Nalcite HCR-W, regardless of the type of cation resin used, but due to possible density differences which may adversely affect anion exchanger performance, addition of SBR-P to other anion exchangers, exception in mixed beds, should be made only after study. To be sure of your replacement resin benefits, consult your demineralizer equipment manufacturer, who can engineer these new improved ion exchangers into your demineralizer. Write us if you have any questions.

Data on Ion Exchangers

Progress in the practical science of using ion exchangers efficiently is discussed in Nalco Reprint 84: "Developments in the Understanding of Ion Exchange." Practical ion exchanger applications, improved laboratory methods, new ion exchange materials, and more efficient operating technique are discussed.

New Nalco Bulletins: (HCR-W) Z12 and (SBR-P) Z13 provide extensive technical information on these efficient Nalcite Ion Exchangers. Your request for any or all bulletins will be honored promptly.

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Nalco® ... Serving Industry through Practical Applied Science

Nalco CHEMICALS
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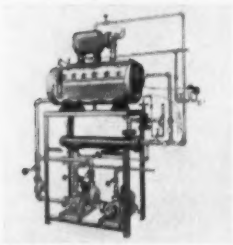
specialists

in complete condensate handling and boiler feeding systems

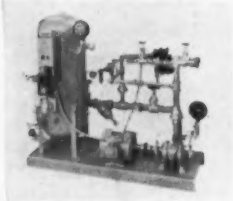
SCHAUB

stays with you from start to "phase-out"

TYPICAL COMPONENTS



ZERO-OXYGEN DEAERATING SYSTEMS
Guaranteed oxygen removal to .005/cc liter under 10-to-1 load swings, up to 250,000 lbs./hr. Other deaerators for smaller needs.



QUIK-TEMP HEATING AND DRAINAGE SYSTEMS
Continuous steam and air removal eliminates steam traps and drainage device maintenance.

1. **YOU STATE YOUR NEED**—with no "ifs" or "buts".

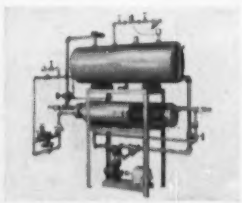
   For instance, you may need a complete condensate handling and deaerating system, starting with outlying condensate return units discharging to a central surge tank. *Plus* transfer pumps with sequence controls to feed the deaerator itself. Finally boiler feed pumps and the controls to make the whole system work — with any degree of automation you require.

2. **SCHAUB WILL ENGINEER AND DELIVER** you such a system — or any part of it — and underwrite its continuous performance. All components are "phased-out" to work together as an integrated and balanced whole.

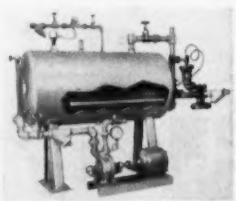
3. **OR WE WILL SUPPLY** you with individual packaged units — from pumps to console blowdown systems — to expand, augment or improve an existing system.

This is what we mean by Schaub "one-source" responsibility. From concept, through design to installation and service, you go best when you go Schaub — *all the way.* Hundreds of Schaub owners and engineers agree!

PACKAGED CONTINUOUS BLOWDOWN SYSTEMS
Automatic flash heat recovery, timer flush, sample cooling, drain aftercooling, high level shutdown, for any number of boilers.



HEAT RECLAIM SYSTEMS
Save about 10% on fuel with large percentage high pressure return systems.



PREE-HEET SYSTEMS
Stretch boiler capacities during peak loads while maintaining optimum pressures. Prolong life of boilers and return lines.

FACTORY-TRAINED REPRESENTATIVES COAST-TO-COAST. SPECIALIST ENGINEERS TO ADVISE, SUPERVISE INSTALLATION AND INSTRUCT IN MOST EFFICIENT OPERATION.

FRED H. SCHAUB ENGINEERING CO.
2103 S. Marshall Blvd., Chicago 23, Illinois

Please send my copy of technical data and Catalog No. 55-D.

NAME_____

CLIP AND ATTACH TO YOUR LETTERHEAD

through revenue bonds. City Plan Commission Chairman Paul Hamilton expressed confidence that the facility could pay for itself from parking fees. The base of the five- or six-level facility would be 30 to 40 feet above the street. Each level would be 10-ft high.

Mass Transit for L. A.?

A 43.5-mile rapid transit system has been recommended to the Los Angeles Metropolitan Authority by the consulting firm of Daniel, Mann, Johnson & Mendenhall. The initial system calls for routes extending generally northwest, east, south, and west from downtown Los Angeles. They would stretch out to North Hollywood, El Monte, Compton, and West Los Angeles. The full network outlined for construction in the next 20 years would consist of eight routes and would serve an area extending from Santa Monica on the west to Covina on the east, and from San Fernando on the north to Long Beach on the south.

The Trans-Canada Highway

In the furor over the Interstate program, Canada's cross continent road building project has received little attention. The 5000-mile road from St. Johns in Newfoundland to Victoria, B. C. is expected to be completed in the next two years. As contemplated in the Trans-Canada Highway Act of 1949, completion was scheduled for 1956. Since that time, costs have nearly doubled and the original completion date long abandoned. Coincidentally, it was in 1956 that both Canada and the U. S. came up with a 90-10 sharing proposal to the states and provinces.

Metal Building Manual

The Metal Building Manufacturers Association has published a "Recommended Design Practices Manual" which is available from the Association at 2130 Keith Building, Cleveland 15, Ohio. Objective of the Manual is to insure

PEERLESS PUMPS

PEERLESS FULLY APPROVED FIRE PUMPS...

FULLY APPROVED UL FM

Prudential Insurance Co. takes no chances on fire in its recently erected Chicago Office Building. Peerless pumps give immediate protection against fire *automatically*, without human attention.

HOW TO DEAL WITH A FIRE BEFORE IT STARTS!

To insure adequate protection against the hazards of fire, a qualified independent fire protection system is a must. And to be doubly sure of the best system, the vital heart of the unit, the pump, should be the best money can buy. That's where Peerless *fully-approved* fire pumps excell.

Throughout a third of a century, Peerless fire pumps have attained an enviable and pre-eminent reputation in protecting all types of buildings, plants and warehouses. Put this know-how to work on your protection problem. See how Peerless' combination of top quality fire pump equipment, exacting engineering application and nationwide service can serve you best. In many instances, the savings effected thru more favorable insurance premiums can pay for the installation. For fire pumps at their very best look to the leader, look to Peerless. Write for bulletin B-1500 today.

Available with steam turbine, engine or electric motor drives, Peerless fire pumps are available for high pressure sprinkler systems, or foam smothering systems in every kind of commercial, or industrial installation

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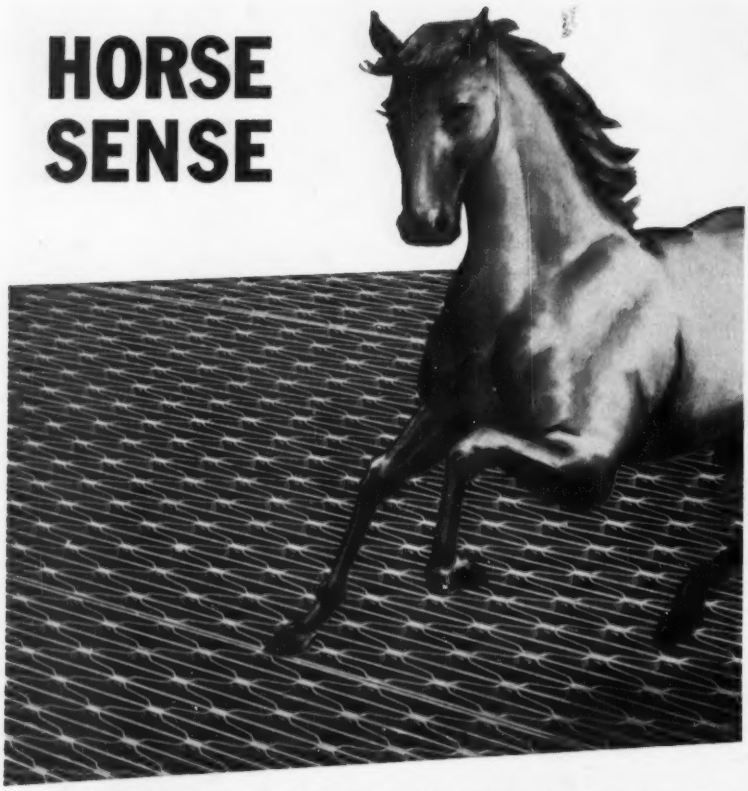
HORSE SENSE



FROM IMAGINATION

Your Grating Ideas Can Be Put to Practical Use

In planning your construction job or architectural design, you may be thinking of a novel use for open metal grating. Before you dismiss your idea as unworkable, check it with the Irving company. Irving engineers have an unusual knack for making "horse sense" from imaginative ideas about grating. This know-how is yours free. It can help you put seemingly impractical ideas to practical, economical engineering use.

No matter what feature of grating your idea stresses—drainage, strength, safety, light weight, appearance—you'll find the Irving experience helpful. Write or phone today. Let Irving help you put across your new grating ideas.

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high quality metal buildings. The section dealing with the application of loads, including load combinations, is equally applicable to all types of construction.

Land Development Engineers

The Association of Urban Development Engineers of Toronto was officially organized in November 1959. The local organization is composed of about 30 members representing firms active in land development projects in the Toronto area. Membership is open to individuals who are qualified registered professional engineers who are principals in their firm. In addition to operating within the framework of the Engineer's Act for the Province of Ontario, the group has drawn these aims and objectives:

¶ Encourage the exchange of professional and business information.

¶ Foster good public relations for the group and provide a spokesman representing the Association's position in dealing with other interested authorities.

¶ Provide leadership, guidance, and self-improvement.

¶ Provide an opportunity for the members to develop an association with one another in the spirit of friendship and confidence.

¶ Develop and practice a uniform interpretation of the Fee Schedule as recommended by the Association of Professional Engineers of Ontario and expand it to apply in areas unique to the land development field of practice.

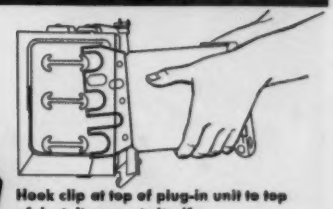
Engineer-Scientist Creativity

A new aid to improving engineer-scientist creativity is offered by *Barriers to Creativity*, a recently completed study from Deutsch & Shea, Inc., technical manpower consultants. Designed for distribution to technical staff members, the booklet explores ways to recognize and overcome obstacles to the creative process confronting technical professionals. Copies of the study will be available singly at $1.50 or in quantity at special rates. In-

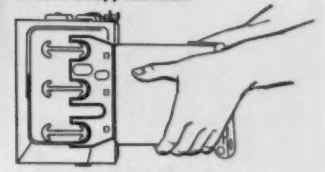
Why SQUARE D ALUMINUM PLUG-IN DUCT?

Because you want a duct that's rugged – built to thrive on heavy duty – *plus*

PLUG-IN UNITS GIVE YOU EXCLUSIVE *hook-swing* MOUNTING



Hook clip at top of plug-in unit to top of duct. It supports itself



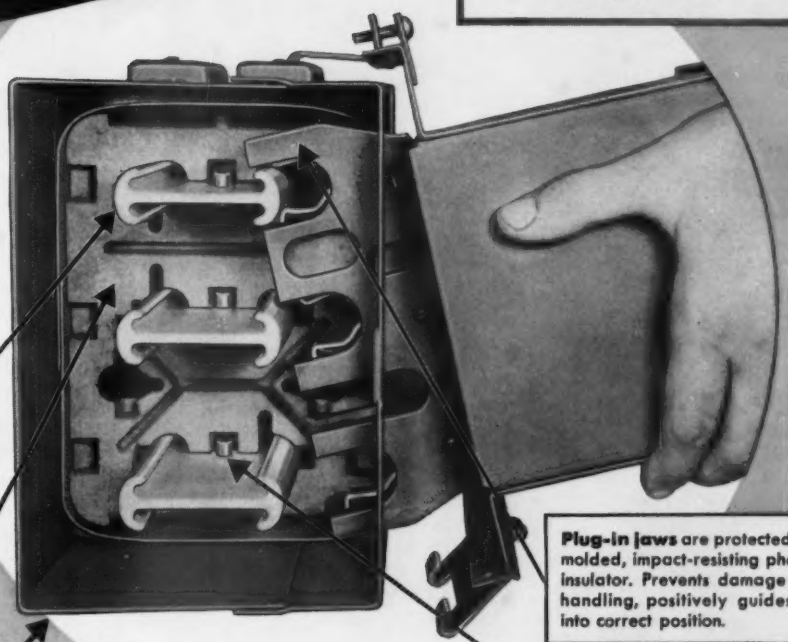
Then, just swing plug-in unit down until jaws engage bus bars

Hanger mounting (*not shown*) makes installation easy. A universal hanger permits mounting in *any* position. Just suspend and level top portion of hanger, then clip on lower portion. U.L. approved for 10-foot spacing.

I-beam construction of bus bars—a Square D exclusive—provides four times the strength of conventional bus bars. Bars are zinc, copper and silver-plated full length.

Full width bus support provides greater strength on short circuits, freedom from vibration. Also acts as fire stop where duct passes through walls and floors.

Square D duct is totally enclosed for maximum safety—no danger of accidental shorts. Prevents overheating from dust accumulation.



Plug-in jaws are protected by a molded, impact-resisting phenolic insulator. Prevents damage from handling, positively guides unit into correct position.

Steel pins in each bus bar prevent bars from shifting and support them on vertical riser installations.

With other plug-in duct, it's no easy job to mount the plug-in units. In fact, it takes a lot of real pushing which is neither safe nor easy when you're working on a ladder. With Square D's exclusive *hook-swing* mounting, you just hook the plug-in unit to the top of the duct. Then, simply swing it down and in until the jaws have engaged the bus bars. No awkward pushing required—no unnecessary chances to take. Compare Square D's rugged, heavy-duty construction with any other. It costs no more—why settle for less?

Write for Bulletin SD-110. It gives the facts on Square D aluminum plug-in duct. Address Square D Company, Mercer Road, Lexington, Kentucky

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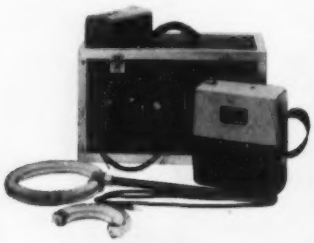
FOUR WAYS TO INSURE GOOD COATING PROTECTION

Continuity is all important in a protective coating. Whether it's a 90 mil coating on a pipeline or a 3 mil coating on a chemical tank, a tiny pinhole can lead to the destruction of the coating. Use of a Tinker and Rasor Holiday Detector will quickly locate pinholes as well as weak spots caused by air bubbles, coke, rust or scale. Minutes spent inspecting with a Tinker and Rasor Holiday Detector while the job is open can save days of down time later on.



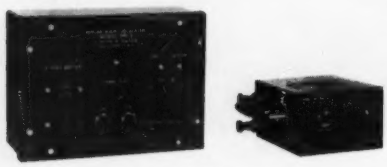
Pipeline Detectors

E-P For damp or dry surface, high electrical resistance coatings. Output adjustable from 8000 to 20,000 pulsating voltage. Electrodes available: half circle, spring for pipe to 6", full circle to 30" silicone brush for flat surfaces.

E-4 This lower cost type of detector is specifically designed for smaller diameter pipe and flat surfaces with dry surface, high electrical resistance coatings. Output adjustable from 8000 to 20,000 D.C. voltage.

Thin Film Detector

M-1 For painted or sprayed thin film coatings. Maximum applied voltage 67½ V., non-destructive to coatings. Belt mounted, 4 lbs. total wt.



Underground Pipeline Detector

P-D For detecting holidays, electrical contacts or locating the pipeline itself, **without uncovering the pipeline.** Completely transistorized—long life and light weight.

Engineering Note:

Every protective coating specification should include TR Holiday Detector inspection. Write for specification guide.

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Quality Control for Coating Application

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quiries should be directed to the publishers, Industrial Relations News, 230 West 41st Street, New York, New York.

Incinerator Criteria

The first draft of "Criteria Used in the Examination of Applications for Permits to Install Direct Fed Incinerators" is being distributed to engineers, architects, installers, and manufacturers of equipment, by the New York City Department of Air Pollution Control, it was announced by Commissioner Arthur J. Benline. One hundred and fifty copies have been distributed for review and comment.

Commissioner Benline stated that "it is the hope of the Department that proper use of these criteria and conformity with the Rules and Regulations of the Department will help expedite the examination of plans, as well as improve installations and minimize air pollution." He said additional copies of the criteria, for persons in the field of incineration, are available and may be obtained by writing to the Department, 15 Park Row, New York 38, New York.

Commissioner Benline emphasized that the criteria, at present, are not for publication, but for review and comment only. "We want the best thinking we can get on this matter," he said, "and that is why we are asking those closest to the problem for their opinions."

California's "No Smog" Bill

Under a new bill given final passage by the California Legislature, all new cars must be equipped with a smog control apparatus within one year after two such devices have been found to be acceptable. Similar regulations will govern used cars and commercial vehicles. A 13-member motor vehicle pollution control board will set up standards for pollution control devices and issue certificates of approval after tests. To carry out the bill's provisions, the Health Department was given an appropriation of

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It's one thing to catalog a complete line of long-tangent fittings . . . it's another to have them ready to ship to your plant—*when* you need them. Speedline engineering and manufacturing experience has "standardized" production on even the most specialized fittings . . . including eccentric reducers, reducing tees and crosses . . . making it possible to maintain extensive inventories both at the factory *and* in the field.

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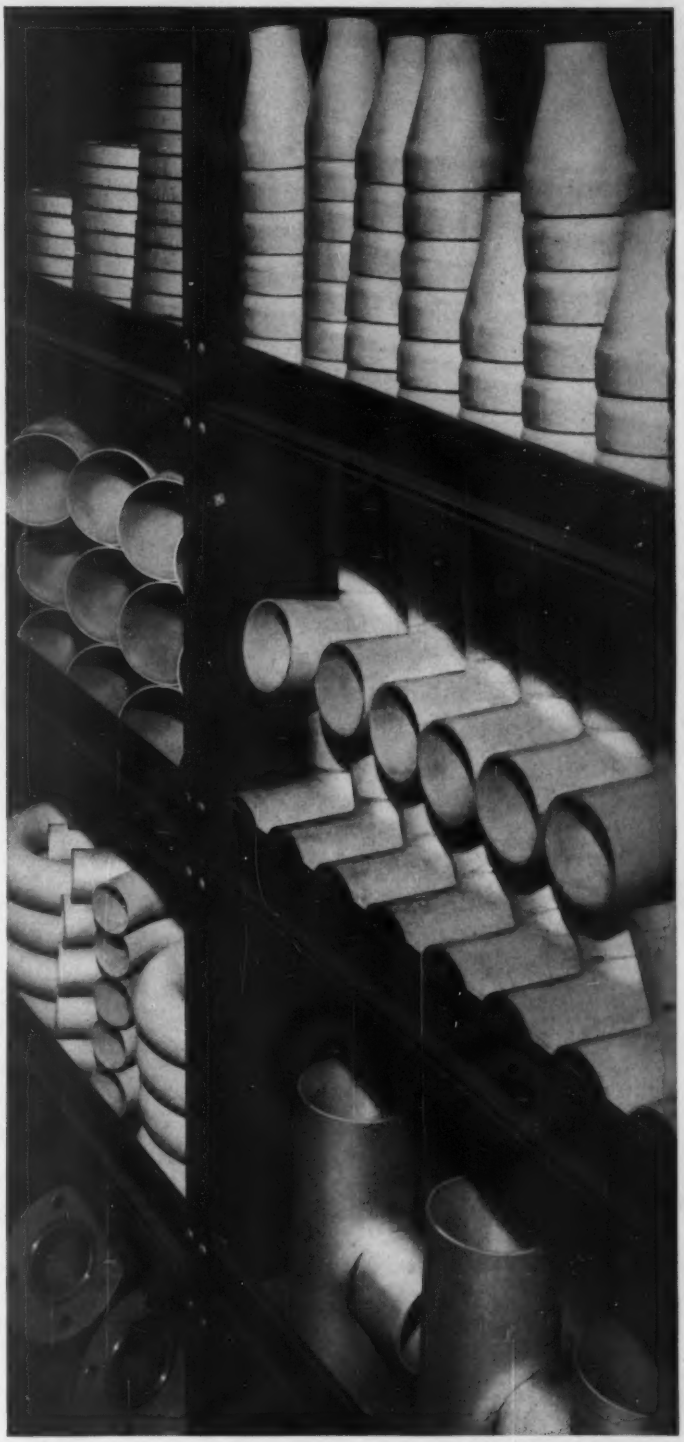
Leading plants have proved there *is* a measurable difference with Speedline fittings . . . the only complete line of long-tangent fittings available from distributor stocks. Let a Speedline distributor prove the difference Speedline experience and ready availability can make at your plant.



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$500,000. It is predicted that South ern California will have no smog within five to six years.

Bidding By Consultants?

The State Highway Department of New Jersey will undertake an immediate study of Newark's transportation needs to complement the city's general urban renewal plans. The project will be a short range undertaking incorporated in the long range $2 million transportation survey of northeastern Jersey. State Highway Commissioner Dwight R. G. Palmer reports that the state already has had two bids from private traffic consultants, which are now under consideration. The survey is expected to cost about $160,000.

Government Patent Policy

In all probability Congress will not vote any change in government patent policy this year. This will be disappointing to those firms holding U. S. government contracts because they now have few rights in inventions developed while working for the government. Title often goes to the U. S. government, which then opens the patents to all, royalty free.

Colorado Interstate Route

A recommendation that a proposed Federal interstate highway through western Colorado follow a southern route across the Continental Divide at a cost of more than $78 million was made by the E. Lionel Pavlo consulting engineering firm of New York. The proposed route would follow U. S. Highway 6 from Empire Junction via Vail Pass with a tunnel under the Continental Divide at Straight Creek. The route would end up at Dotsero.

Ernest T. Perkins, of the Pavlo firm, who presented a report to the Colorado State Highway Commission, said the 99.3-mile route would cost approximately $78 million. More than $28 million of the total project cost will be spent on a twin-

CLEARWATER FINISHING
GETS SAVINGS
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PACKAGE AIR PREHEATER

Fuel savings alone pay for it in two years; installation costs cut by pre-assembly — —

Savings come in pairs at Clearwater Finishing Co., with the installation of their new Package Air Preheater. This is why:

1. Initial savings on installation. You can install a Package Air Preheater at a fraction of the expense required for conventional heat recovery equipment. The unit you see in the picture is a *complete* Package Air Preheater. To put it into service you simply lift it into place, make power and duct connections. It's that fast, that easy.

2. Long term fuel savings . . . $17,000 a year off your fuel bill (more or less, depending on size of preheater and application). What you save on fuel can pay for the Package Air Preheater within two years.

Installation savings are achieved through standardized design, which permits complete shop assembly. Fuel savings are achieved through the efficient continuous regenerative heat recovery principle, which cuts your fuel bill 1% for each 45-50°F increase in preheated air temperature.

For application ideas, and facts and figures on the potential savings, write for free 14-page booklet.

Completely pre-assembled Package Air Preheater is lifted into place at the new plant of Clearwater Finishing, (Division of United Merchants & Manufacturers, Inc.) at Clearwater, South Carolina. Installed at far less cost than a unit requiring on-site erection, this Package Air Preheater will serve a 83,000 lb/hr boiler. It measures approximately 8'x8'x6', and its 4900 sq ft of effective heating surface will recover 290°F from the stack gas.

THE AIR PREHEATER CORPORATION

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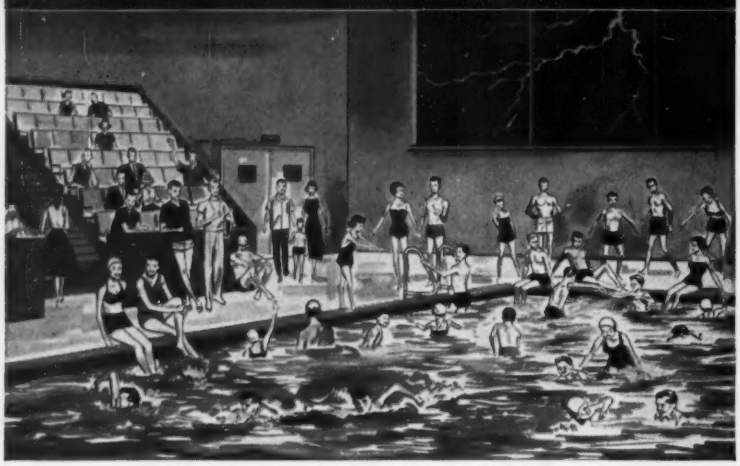
Where power blackouts must not happen



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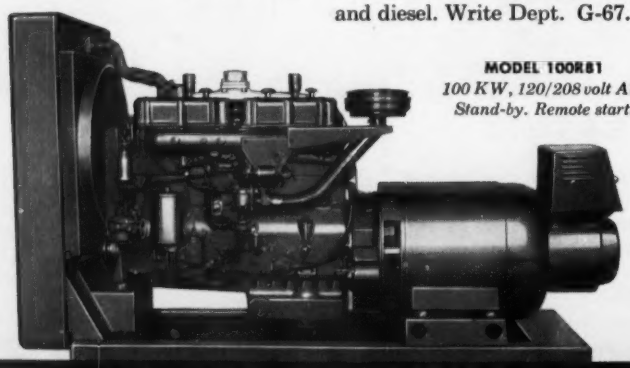
ELECTRIC PLANTS

Sudden darkness can cause panic and disaster.

When normal power fails, Kohler electric plants provide immediate electricity—lighting for swimming pools, auditoriums, gymnasiums, corridors, stairways, exits, power for automatic heat.

Increasing dependence on electrical equipment makes emergency power vitally important in schools, hospitals, other public and commercial buildings as well as the home. And Kohler electric plants are known everywhere for reliability.

To help you write specifications for varied applications, Kohler Co. will send on request a manual with data on sizes from 1000 watts to 100 KW, gasoline and diesel. Write Dept. G-67.



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100 KW, 120/208 volt AC.
Stand-by. Remote start.

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Enameled Iron and Vitreous China Plumbing Fixtures • All-brass Fittings
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bore tunnel at Straight Creek. The new highway will consist of four lanes, with 14 interchanges. It is expected to be one of the most scenic highways in the country and will improve access to an outstanding recreation area.

Blatnik Turns to Oklahoma

Charges that a $3 million interstate project was built in a manner not in accord with specifications were aired by the Blatnik Subcommittee of the House Public Works Committee. The project, known as the Skelly Bypass, is a 9-mile stretch of a 16-mile highway near Tulsa, Oklahoma. Significance of the Skelly Bypass hearing lies in the fact that this is the first instance of a public hearing before the Blatnik Subcommittee in which there is an implication that deliberate wrongdoing may have occurred on the highway program.

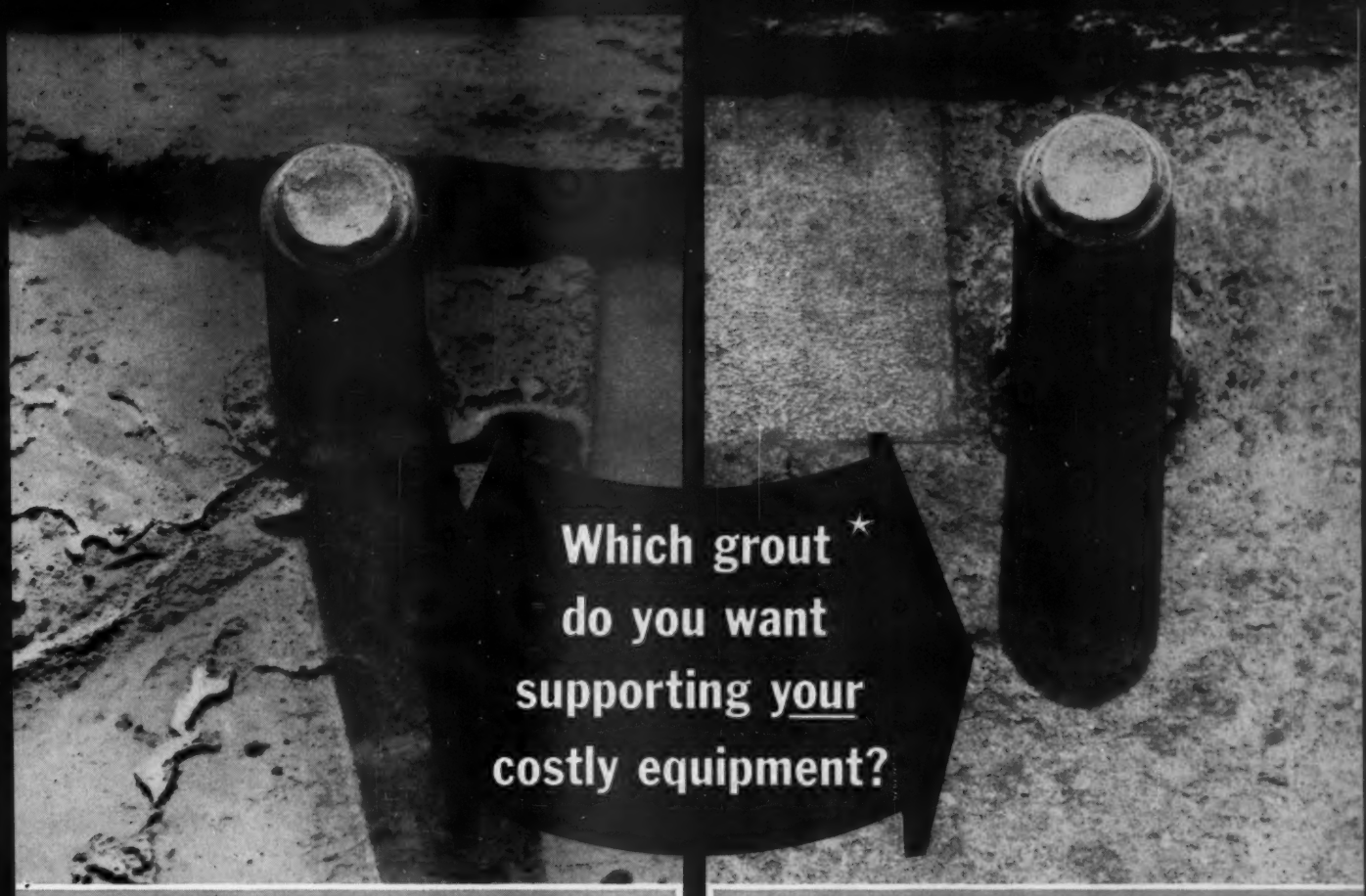
BPR Policy Changes

The Bureau of Public Roads, on May 1, put two revisions into effect. The minimum advertising period acceptable for Federal-aid contracts is now three weeks (instead of two), except when emergency conditions justify a speed-up. Division engineers may, at their discretion, give tentative advance approval orally to major changes in plans and contract provisions, but must ratify such approval in writing as soon as possible.

Harbors Report

Capital expenditures amounted to almost $22.5 million, according to the National Harbors Board of Canada in a report on 1959 activities. A number of important new facilities were completed and put into operation, but uncompleted work on major contracts at the year end amounted to almost $11 million. In addition, $4 million was spent on the maintenance of existing facilities.

The report states that major construction projects completed or in progress during 1959 included new



PLAIN GROUT SHRINKS . . . leaves only a web of mortar and a small shim area to support the equipment baseplate. Result is a *short-life* grout that causes shutdowns . . . possible equipment damage . . . and expensive re-grouting.

EMBECO GROUT IS NON-SHRINK . . . readily and solidly fills the space to be grouted and permanently retains its original volume. Provides full, even baseplate support . . . helps assure proper equipment positioning and alignment. EMBECO means dependable, *long-life* grout.

Today's figures show that *machinery* for the average U. S. factory costs $4,680,000[1] — a sizeable, important investment geared toward smooth, efficient production. But the *grout* under this valuable equipment *costs only pennies* by comparison.

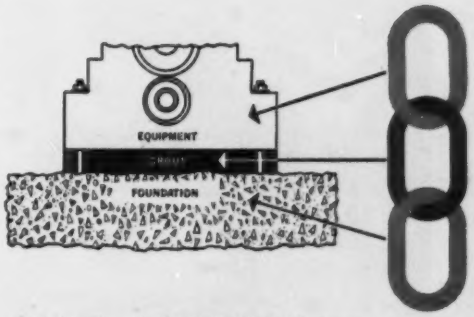
Compare the grouts pictured above. It's clear evidence that EMBECO can save *you* costly re-grouting and production downtime.

Here's why EMBECO means a superior grouting job every time—

- **Non-Shrink** . . . assures tight, level, permanent contact with equipment baseplate.
- **Flowable** . . . quickly, completely fills the space, increases ease of placeability.
- **Strong and Tough** . . . withstands impact, pounding action, vibration, side thrust and torque . . . maintains perfect alignment.

Before *you* grout another piece of heavy equipment—call in the local Master Builders field man for full information, or write to us for details on how EMBECO can help you *grout for good.*

[1]*U.S. average*—initial *machinery and equipment costs for new factories.*



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or improved wharves at Chicoutimi, Montreal, and Vancouver. New transit sheds were erected at Quebec, Montreal, and Vancouver, and a transit shed extension at Montreal. Additions and improvements were made to the grain elevator systems at Halifax, Saint John, Quebec, Montreal, Prescott, and Vancouver. At Montreal, improvements to the approaches and roadways of the Jacques Cartier Bridge continued, while piers and superstructures were constructed and fill placed for the Champlain Bridge. Various small projects were undertaken to improve shipping, storage, and traffic facilities at the national ports.

Hertz Scholarship Foundation

The board of directors of the Hertz Engineering Scholarship Foundation announced at its annual meeting in Los Angeles that future scholarship activities, beginning with 1961 grants, will be expanded to include all fields of engineering. Also announced was the establishment of an expanded sponsored scholarship program. This new program makes Hertz Foundation's administrative facilities available without cost to persons, corporations, or other organizations who wish to establish engineering scholarships. The scholarships are identified by the donor's name, and all funds subscribed under this plan are used exclusively for student assistance. No charge will be made for expenses that will be incurred in screening, selecting, and notifying candidates.

T-1 Steel For Hydro Projects

Four huge hydroelectric turbine spiral casings are now in use on the recently completed Noxon Rapids Hydroelectric Development, in Noxon, Montana. Ebasco Services Incorporated, the engineering and construction firm for the project, reports that each casing is 24 feet in diameter and weighs 108 tons. They are said to be the largest ever constructed with T-1 steel.

Meanwhile, in Calgary the remaining sections of a 1600-ft long penstock for the Spray development extension being undertaken by Calgary Power Ltd., near Canmore, Alberta, soon will go into operation. Montreal Engineering Company, consulting engineers and designers on the project have specified T-1 steel on all of the penstock work.

T-1 is a low carbon, quenched and tempered alloy plate steel which develops a 90,000 psi yield with a 105,000 psi tensile strength. T-1 steel offers the designer exceptionally high tensile strength combined with toughness at low temperature and good welding properties. It has a Brinell hardness of approximately twice that of regular mild steel and does require special fabricating techniques for flame cutting, rolling, and especially welding. ▲▲

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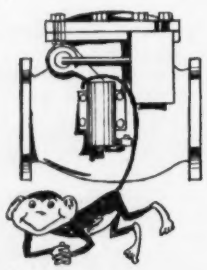
Don't monkey with hammer and shock in your water lines. Use a G-A Cushioned Swing Check Valve with the special cushion chamber that eases it through the last 5% of its stroke. Let the valve with the built-in "pillow" protect your equipment.

Write today for Bulletin W-1A.



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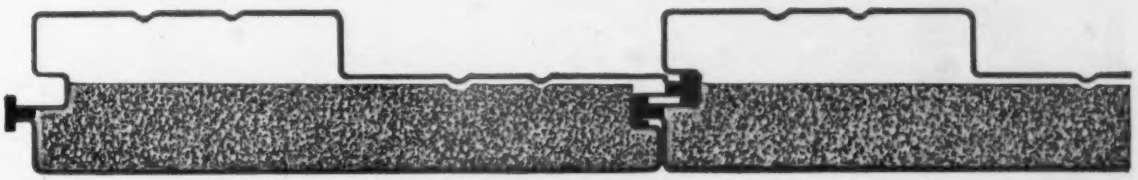
MONOPANL®

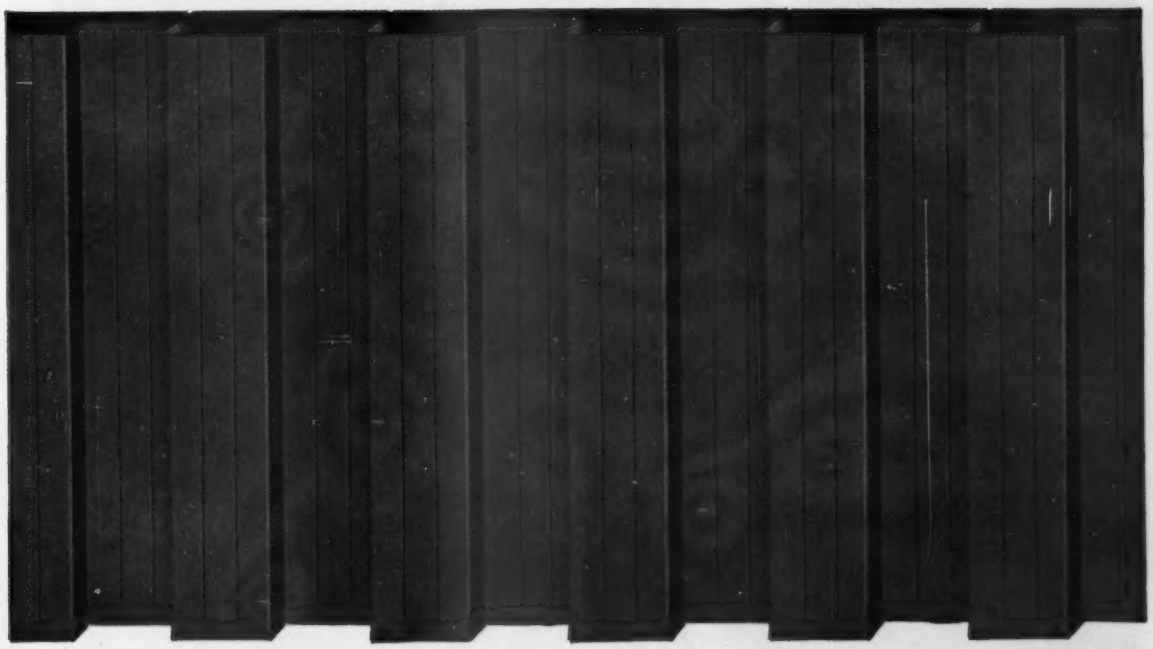
A factory-assembled wall panel in one foot modules . . . one that is self-sealing for life by mere installation. You never caulk it. And there are no visible outside joints or fasteners to mar the surface. This is Butler Monopanl, the most unusual curtain wall. Tongue-and-groove joints with double vinyl gaskets provide the seal. The cross section sketch tells the story.

Spanning ability is exceptional, as you can see from the configuration. Glass fiber insulation will not settle.

Beautiful Monopanl is furnished in a range of gauges. Exterior and interior faces can be specified in aluminum or galvanized steel. Choose from a selection of factory-applied colors. Integral fenestration is available.

For further information refer to Sweet's 1960 Architectural File. For complete technical details and actual samples of Monopanl, contact your Butler Builder He's listed in the Yellow Pages under "Buildings" or "Steel Buildings." Or write direct for a descriptive brochure and data sheets.





"See Sweet's Industrial or Architectural File—Section 8-B"

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Assembling 16" "K&M" Asbestos-Cement Pressure Pipe by hand without the aid of a bar. The backhoe merely steadies and aligns the pipe. The easy, two-step operation consists of (1) lubricating the tapered end of the pipe, and (2) sliding pipe into coupling.

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A SHOVEL DIGS..."

G&B Construction, Inc., Youngstown, Ohio, installs 4½ miles of "K&M" Asbestos-Cement Pressure Pipe for the Austintown District of Mahoning County, Ohio

"You can lay 'K&M' Pipe as fast as a shovel can dig. There is nothing that will hold you back with this pipe. When you can lay a 16" water line, and it goes in as easy as an 8" water line, what more could you ask? They've got a good joint with that FLUID-TITE® Coupling . . . the pipe is wonderful to put together. There is no comparison between the FLUID-TITE Coupling and other couplings. Of all the 'K&M' Pipe we've laid, we never had a coupling break. Coupling breaks are very common with other pipe."

Those are the comments of Louis Gulfo, partner with Mike and James Bertilacci in G&B Construction, Inc. They installed "K&M" Asbestos-Cement Pressure Pipe in bitter cold, during February and March 1960. However, neither rain, snow, nor mud interrupts the installation of this modern pipe. The exclusive, patented "K&M" FLUID-TITE Coupling and the simple fitting procedures required make assembly easy.

Little or no maintenance will face Mahoning County, which built and will operate the system for a year, or the City of Youngstown, Ohio, which will then take it over. Being non-metallic, "K&M" Asbestos-Cement Pressure Pipe won't rot, corrode, or tuberculate, and is immune to electrolysis. The suppliers of this pipe were Trumbull Plumbing Supply Co., Warren and Youngstown, Ohio.

Now, in addition, you may use quality "K&M" Plastic Pressure Pipe in the same system with "K&M" Asbestos-Cement Pipe, if desired.

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Keasbey & Mattison at Ambler

Left to right: Louis Gulfo, G&B Construction, Inc.; Dale MacCleary, sales manager, Trumbull Plumbing Supply Co.; James Bertilacci, G&B Construction, Inc., Burke Lyden, Asst. Chief Engineer, Youngstown, Water Dept., Jim Bisciglia, Asst. Engineer, Mahoning County, and J. Henry Painter, Trumbull Supply Company.

3 miles of 16" "K&M" Asbestos-Cement Pressure Pipe were installed. Here, we see it ready for installation along Webb Road, in Austintown Township. In branching from the 16" water line, Mahoning County used 1 mile of 12" "K&M" Asbestos-Cement Pressure Pipe and ½ mile of 8" "K&M" Asbestos-Cement Pressure Pipe. Specifications call for 90 lbs. pressure when line is in operation serving 16,000 residents.

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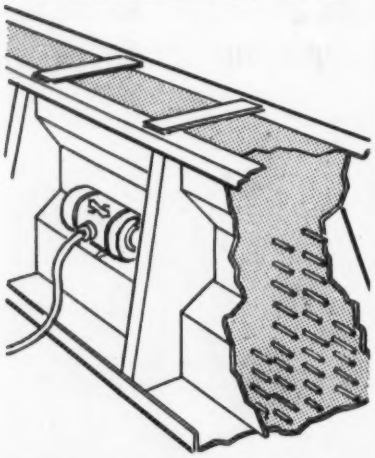

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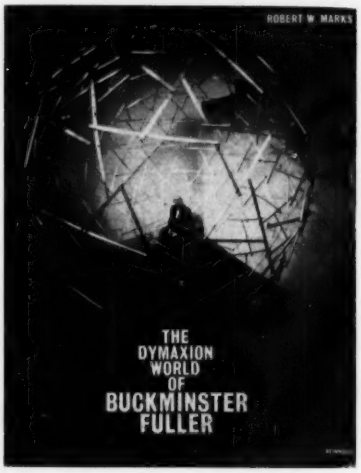
Parallel Reading for Consulting Engineers

The Dymaxion World of Buckminster Fuller is another attempt to interpret the psychology and semantics of Bucky Fuller. Written by Robert W. Marks, a friend of 18 years standing, it probably gets as close to the man as anything yet written by or about him. As a nonconformist, Bucky has never expected to be understood, and, in fact, does not even seem to care whether he is or not.

Marks begins with Fuller's concept of the Universe, which is for him an all-encompassing philosophy. That practical things like automobiles, bathrooms, houses, maps, and geodesic domes evolved out of his pursuit of the Universe, seems unimportant to Bucky. As a matter of fact, he has actually left the practical details of his most successful project — the geodesic dome — to younger men. Impractical as he may seem, however, Fuller is a firm believer in patent rights, and he protects his own with some vigor.

But even his interest in patents is part of a greater thing than monetary or personal aggrandizement for Fuller. He believes that the engineer and architect, working for clients or "patrons," is not free to design in his own way. Thus, designers must go off on their own and get full patent protection for their ideas.

When Marks writes about Fuller the man, he is at ease and the book reads well. It is another story when he presents Fuller's ideas. He has attempted to translate Fullerese into common English. It is unfortunate that the ideas do not come through much clearer and that much of the color of the Fuller personality is lost in translation. An introduction to the December 1959 article on "Dome Structures"



was written for CONSULTING ENGINEER by Fuller, and though it was extremely difficult to understand, it was both interesting and thought provoking. There is no doubt that it is as a thought provoker that Fuller will be remembered in the years to come.

•

John Ericsson is remembered, if at all, as the designer and builder of the ironclad Monitor. It probably is fitting that this is so, for the Monitor was the one Ericsson achievement that brought him both popular and professional acclaim.

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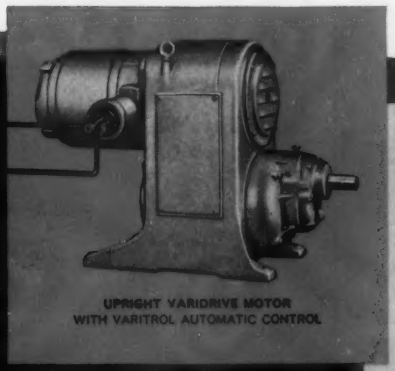

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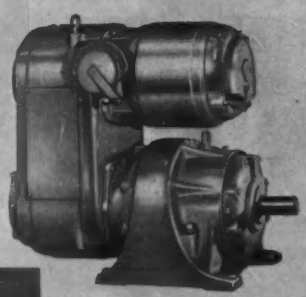

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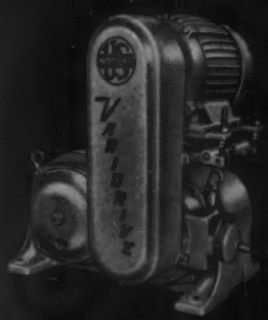

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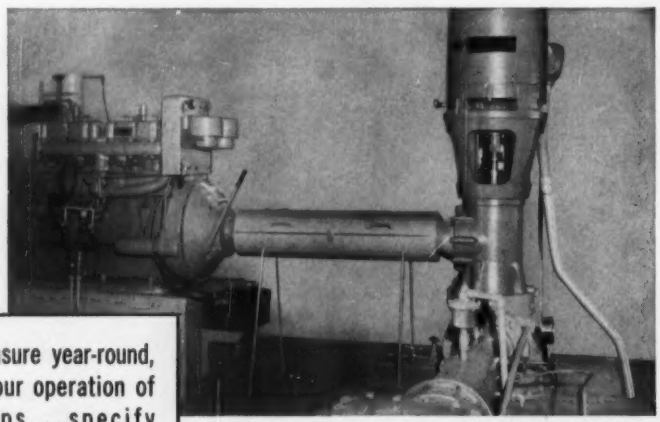

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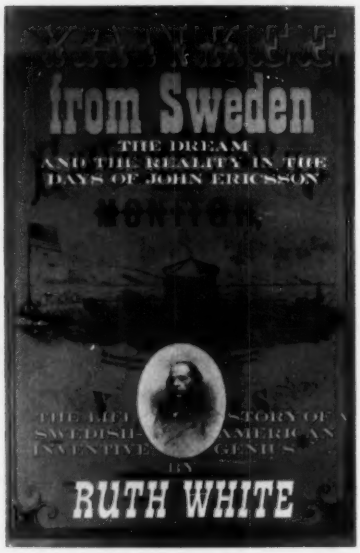
4

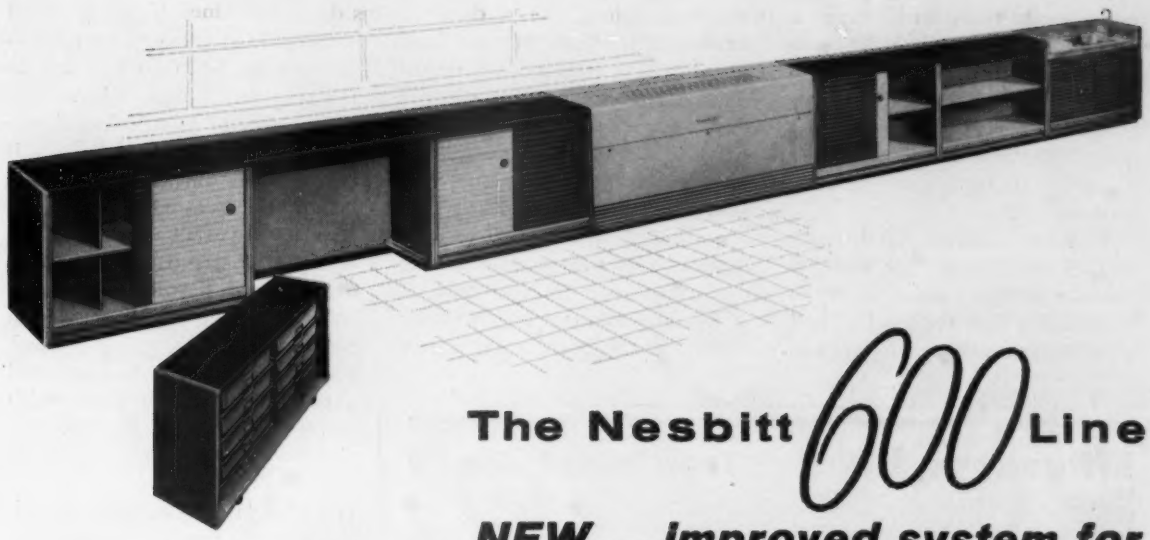
Even the most ardent technical critic of the era, *Scientific American's* ubiquitous Orson Desaix Munn, was forced to substitute the honey of adulation for his usual acid wit. More recently Clarence Buddington Kelland found this time in Ericsson's turbulent career



a suitable background for a serialized novel which appeared in the *Saturday Evening Post*. Although heavily larded with magnolia scented intrigue and romance, it is a well told story and does a good job of sketching the personality of the strong willed Swedish-American genius.

However, like most great men, Ericsson is best presented by a competent biographer. In *Yankee from Sweden*, Ruth White has done an excellent job. She manages to span his 86 years from 1803 to 1889 with a factual record that flows more readily than many novels, even though it is interspersed with frequent quotations and many thumbnail sketches of Ericsson contemporaries.

This is the first biography of John Ericsson written since the publication of one written by William Church in 1907. It is only fair to point out that Church was emotionally tied to his subject's



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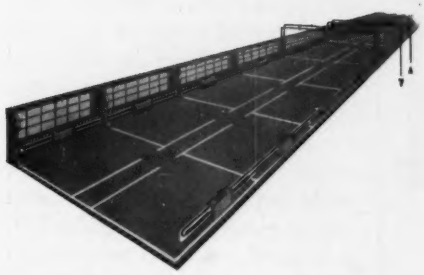

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era, whereas Ruth White can look back with the objectivity best created by time. However, Ericsson is not a man who can be approached without passion, for even today those who have studied his life are prone to take violent issue with each other.

"I, John Ericsson, Civil Engineer, of the City of New York," is the way in which Ericsson began his will. For him, the legal "I" had important meaning, for he was surely an egotist. But, if he loved himself, it is certain that he loved his profession even more, with just a little left over for his adopted city, New York. There was little romance in his life, though he fathered an illegitimate son, was later married and almost as quickly separated, and seemed to have some alliance with another woman during his years in New York. It is almost certain that he gave these women nothing, for even a few days before his death he remained stubbornly at his drafting table — giving what little he had left to the progress of engineering.

The story of John Ericsson's engineering triumphs and failures is an interesting one. A more likable man would have ended up in the company of Fulton, Stephenson, and the other great engineers so frequently written about in books on technical history. For Ericsson there was only a grand funeral, honorable burial in Sweden, and a statue in Potomac Park which was not dedicated until 1926.

•

The Man in the Cage is a considerably better than average mystery story, but from the point of view of our readers, its most interesting aspect is the hero, who is an engineer. Darrell Hudson is, according to plot, a mechanical engineering graduate of MIT. This technical background proves valuable when he is captured by some odd, underworld North African characters and placed in a small suspended iron cage for safekeeping. He applies the laws of physics and thereby makes possible his escape, but it might have been easier if he had been a plumber's apprentice. Still, it is good to have engineers as heroes, and Darrell Hudson is all that a hero should be in North Africa. It is a competently written book and will be particularly pleasing to consulting engineers who are murder mystery fans.

•

A publicity release dealing with Dover's new publication of illustrations from Diderot's Encyclopedia describes this project as "a major publishing venture that has not been attempted since before the French Revolution . . . The French encyclopedia represents the pooled contributions of the finest minds in France during the 18th century. It is certainly one of the great books of Western civilization. These plates have lain dormant for

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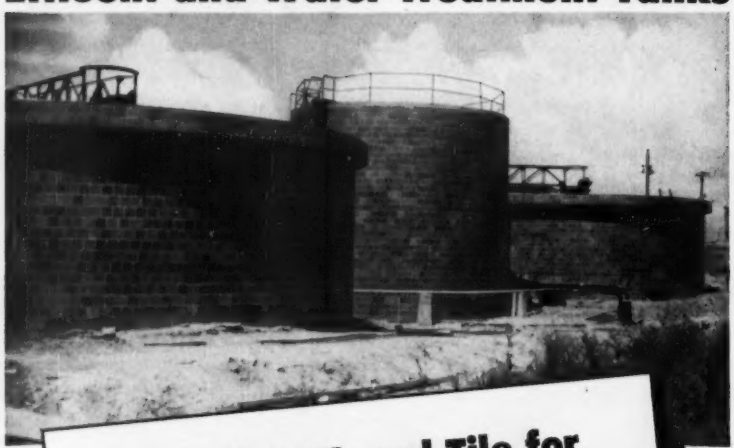

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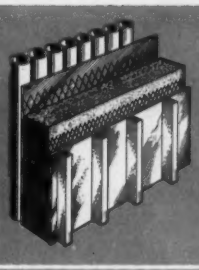

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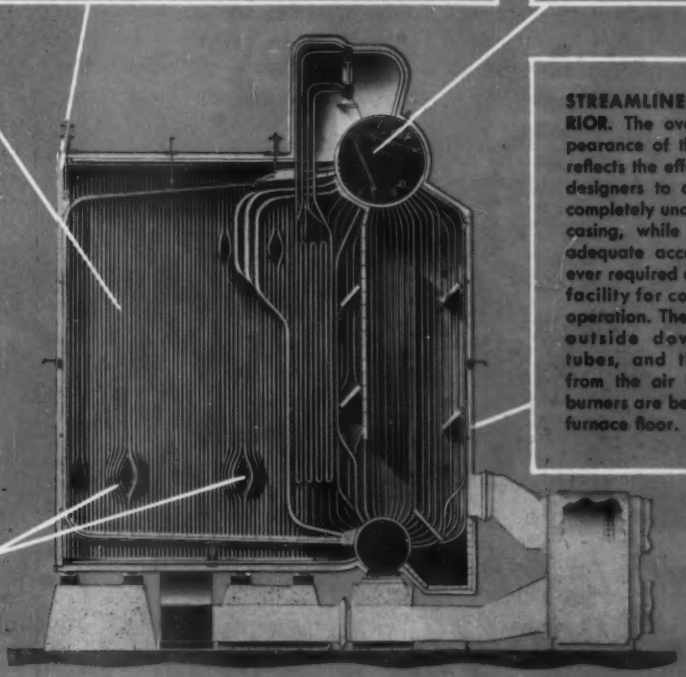

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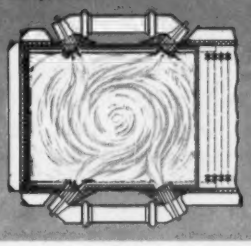

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almost 200 years, yet there is probably no contemporary record of an age that is comparable to them in scope or vastness or so fresh in detail." If this resembles usual publicity blurbs, it differs drastically in that it is actually understatement.

If we were asked how one could best spend $18.50 this year for additions to a consulting engineer's library, we would without hesitation recommend these two volumes taken from Diderot.

Diderot's Encyclopedia dealt not only with manufacturing and technical arts but also with music, medicine, and natural history. Dover hopes to publish more along these lines, but the present two volumes concentrate on industry and engineering. The encyclopedia was the work of many years but it was all accomplished in the last half of the 18th century, and these illustrations show the manufacturing methods and civil engineering designs of the years immediately adjacent to 1750.

These are the finest technical illustrations ever made, and any engineer who starts thumbing through these volumes will never turn to consecutive pages without stopping to admire, study, and learn.

The first two volumes are magnificent. We hope that Dover does not stop until the other proposed volumes are printed.

Incidentally, Charles Coulston Gillespie, associate professor of history at Princeton, has prepared an excellent text to accompany the illustrations, and if there simply must be some adverse criticism, it could only be to timidly point out that Professor Gillespie's introduction may be just a trifle pedantic.

•

Dr. Samuel Johnson, according to all prior accounts, was a Tory's Tory. He was the stubborn reactionary — a great defender of monarchy and a sort of lay protector of the established church.

This was not so at all, argues Donald J. Greene in his new book dealing with Johnson's political opinions. Greene puts up an excellent argument. He proves rather satisfactorily that Dr. Johnson was no Tory and even that there was little Toryism in the Tories themselves. Greene is quite right in saying that labels such as Tory or Whig, Liberal or Conservative, Radical or Reactionary, and even Democrat or Republican, soon attach to themselves meanings that cannot logically be fitted to those who wear them.

British politics in 1750 resembled our modern party system here in the U. S. much more than it resembled the modern British system. Party allegiance was not permanent, and shifts were frequent. To say, then, that a man was a Whig no more meant he was "liberal" in his political thinking than does Democrat today.

Analyzed quite apart from any party, Dr. Johnson turns out to be

Built to take it... Indefinitely!

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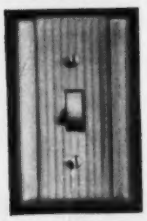

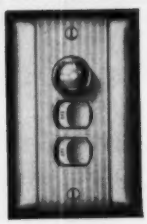

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P&S Rocker-Glo switches are AC switches, designed to be used at full current ratings on tungsten filament and fluorescent loads — one does the work of two AC-DC switches for controlling fluorescent fixtures. Rocker-Glo can be used anywhere old-style toggle switches are used.

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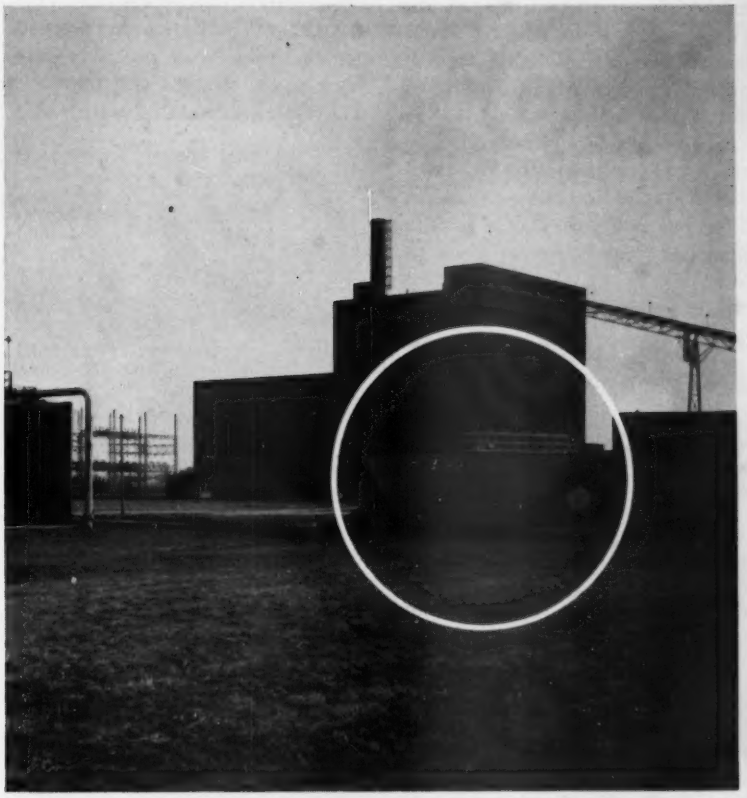

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Bulletins available: Operating details on Permutit Precipitators are contained in Bulletin 2204. Also available: "Outline of Water Treatment Equipment," Bulletin 4433, and our waste-treatment guide, Bulletin 4486. For copies, write to: Permutit Division, Dept. CE-60, 50 West 44th Street, New York 36, New York.

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just what one would expect. He was a traditionalist wherever the advisability of change was not clearly beneficial, but much more important, he carefully examined each topic, each political position, and each issue alone and within its environment. One might say that he took every important question, held it up and examined it, then fitted it back into place and studied it again. He then came to his own conclusions. The result was that he turned out to be a great independent political thinker just as he was a great independent thinker in so many other fields. There was next to nothing about him that could be labeled Tory as we feel the meaning of Tory now. Nor was he a Whig.

Greene has brought together so much good support for his position that one sometimes wonders if he has not protested a bit too much. At some points he seems to be straining to convince, as when he condemns Joseph Wood Krutch for trying to explain Johnson's apparently liberal professions in the *Compleat Vindication* by suggesting that they "were probably pure hack work," bought and paid for. Yet Greene himself casually explains away Johnson's famous remark regarding his reporting of Parliamentary debates (he said he took care that the Whig dogs should not have the best of it) by stating that this was "probably no more than a piece of ordinary jocularity." Likely Greene is right in both instances, but Krutch is as logical in explaining away Johnson's Whig writings as "hack" as Greene is in explaining the "Whig dog" remark as "jocularity."

This is a most excellent addition to the rapidly growing stock of material explaining Johnson and his era. Both Greene and Yale deserve congratulations for this publication.

•

The third printing of the Eighth Edition of AIA's *Handbook of Architectural Practice* has now come from the press. This is the well known handbook revised from time to time by the AIA Office Practice Committee. Over the

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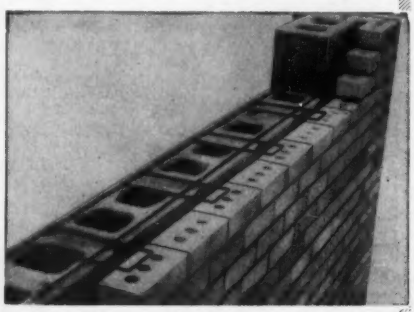

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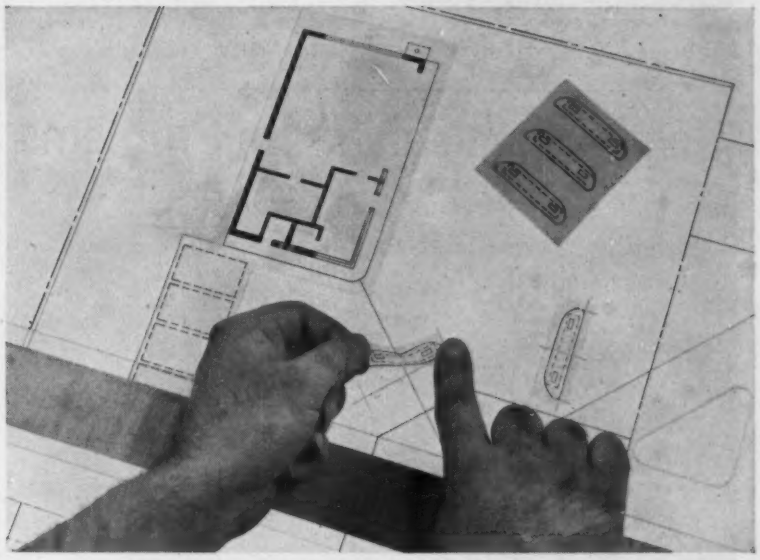

Printed-element drafting ends tedious redrawing of repeated elements . . . produces accurate reproducibles in record time.

The regional engineering office for a large oil company employed 15 draftsmen to prepare construction plans for new filling stations. Investigation of their drafting procedures revealed the majority of "board-time" was consumed redrawing, in varied combinations, the basic elements such as pump islands, hoists, and rest rooms, used in each station. Redrawing of the repeated station elements was tedious work and wasted valuable man-hours. Dietzgen solved this problem by recommending a new *printed-element* drafting technique utilizing Dietzgen's diazo-sensitized, adhesive-backed polyester drafting film. Duplicate originals of all repeated station elements are now printed on the Dietzgen film medium. The draftsman simply selects the proper elements for each station, mounts them on a sheet of Dietzgen polyester drafting film, and the plan is 75% complete without drawing a line! The finished drawing is a high-transparency reproducible, ready to produce any number of prints.

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years, since its first publication in 1920, this book has been familiar to and valuable as a reference not only for architects but for consulting engineers – particularly those engaged primarily in interprofessional practice. This is still to be considered a most important part of the engineer's reference library, but it has become relatively less important with the publication of the first edition of *The Practice of Consulting Engineering, a Manual of Principles and Performance,* just brought out by CEC. This new manual does not pretend to be complete yet. Many sections are marked "Projected" and others are clearly not in the form they will be in when time comes for later printings. Fortunately, this manual has been issued as a loose-leaf publication so that it can be easily changed and brought up-to-date as the project is continued or as changes are made.

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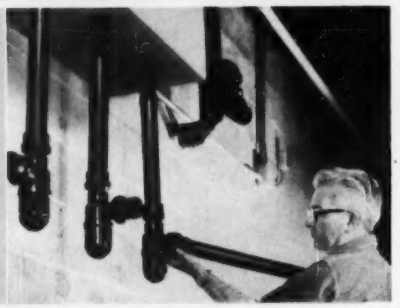

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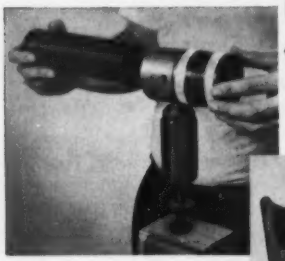

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While this first printing is in serious need of editing and could even stand another proof reading, this does not detract from the fact that it is the first important work of this type to be published for consulting engineers. The price covers all supplementary material, which will be mailed as published.

The seven major sections of the manual are headed: The Consulting Engineer And His Client; Professional Services; Transmitting Engineering Information; Criteria of Performance; Applied Principles of Performance – A Casebook; Organization and Operation of a Consulting Practice; and Consulting Engineers Council.

In this first printing, Section 2 is one of the more complete and better prepared. It discusses the nature and extent of services, advisory and technical services, the services of general practice, procedures of general practice, the services of associated firms, and business and contractual service. This section also contains a number of the Council's published documents, including the General Conditions of Contract; several forms of advertisements, proposals, agreements; and bid and performance bond forms.

Section 6, which breaks down into the organization of the consulting firm, agreements and negotiations, establishing fees, accounting, employee relations, insurance, public relations for individual firms, and policies established by the individual firm, is remarkably complete too. Here also are additional forms for special conditions of contracts in interprofessional practice and some excellent material by the CEC Office Practice Committee on accounting, finance, and fees.

If the manual committee does not tend to relax too much after this first printing, consulting engineers can expect this manual within a relatively few years, to be their single most important guide.

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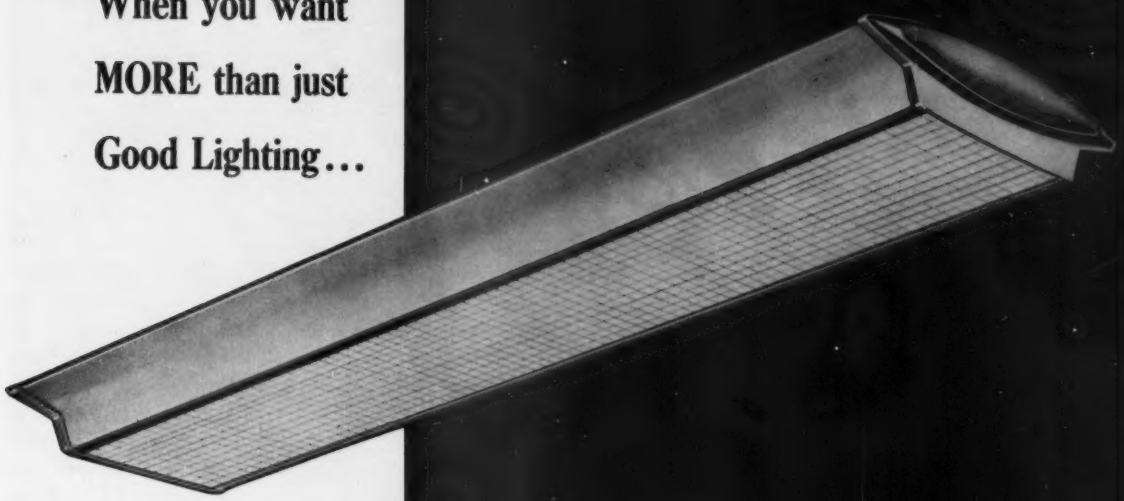

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firms that are members of Consulting Engineers Council. It will be six months before it can be purchased by nonmembers, but orders can be placed now through the Council's headquarters.

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Books Reviewed in This Issue

The Dymaxion World of Buckminster Fuller, by Robert W. Marks; Reinhold Publishing Corp., New York, N. Y.; $12.00.

Yankee from Sweden, by Ruth White; Henry Holt and Company, New York, N. Y.; $4.50.

The Man in the Cage, by John Holbrook Vance; Random House, New York, N. Y.; $2.95.

The Diderot Pictorial Encyclopedia of Trades and Industry, edited by C. Gillespie; Dover Publications, Inc., New York, N. Y.; two volume set $18.50.

The Politics of Samuel Johnson, by Donald J. Greene; Yale University Press, New Haven, Conn.; $5.50.

Handbook of Architectural Practice, American Institute of Architects; $8.

The Practice of Consulting Engineering, Consulting Engineers Council; $15.

New Technical Books

PRINCIPLES OF PAVEMENT DESIGN, by E. J. Yoder; John Wiley & Sons, Inc., New York, N. Y.; $13.25. By presenting the basic principles that will apply to airfield and highway pavements, both flexible and rigid, the author has provided data for establishing design criteria to meet any conditions that may be encountered. More than half of the book is devoted to a compilation of basic data, with the balance dealing with a summary and derivation of design methods. Material presented has been used on the graduate level at Purdue University, and it is assumed that the reader has a basic knowledge of soil mechanics and concrete mixes.

THERMODYNAMIC PRINCIPLES FOR CHEMICAL ENGINEERS, by Roger Gilmont; Prentice-Hall, Inc., Englewood Cliffs, N. J.; $11.00. According to the author, this book was written to fill the need for a basic textbook on thermodynamics for the chemical engineer. It is the author's contention that most textbooks on thermodynamics place more stress on applications than on basic principles. This he seeks to remedy on the basis of his belief that "The time has come to recognize the scientific nature of engineering — that the engineer is primarily a scientist."

FRAMES AND ARCHES, by Valerian Leontovich; McGraw-Hill, New York, N. Y.; $20.00. The author, long associated with consulting engineer firms, has prepared condensed solutions for structural analysis of frames and arches of constant or variable cross section. Over 400 condensed solutions for 20 principal types of statically indeterminate frames and arches are given, with solutions allowing almost limitless variation in members' shapes or cross section. They can be used with designs in wood, concrete, and steel. ▲▲

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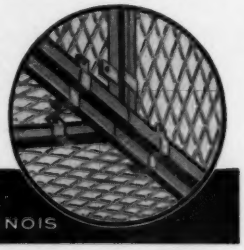

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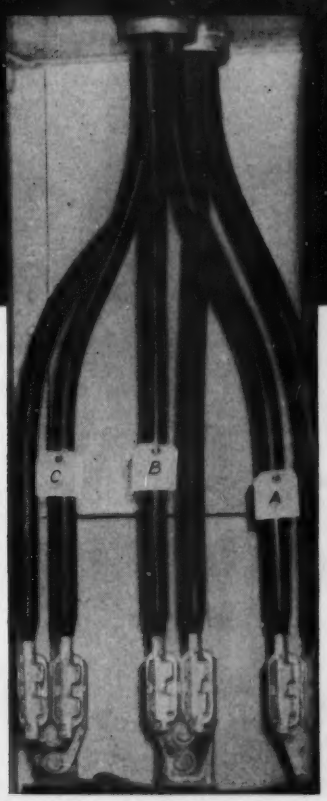

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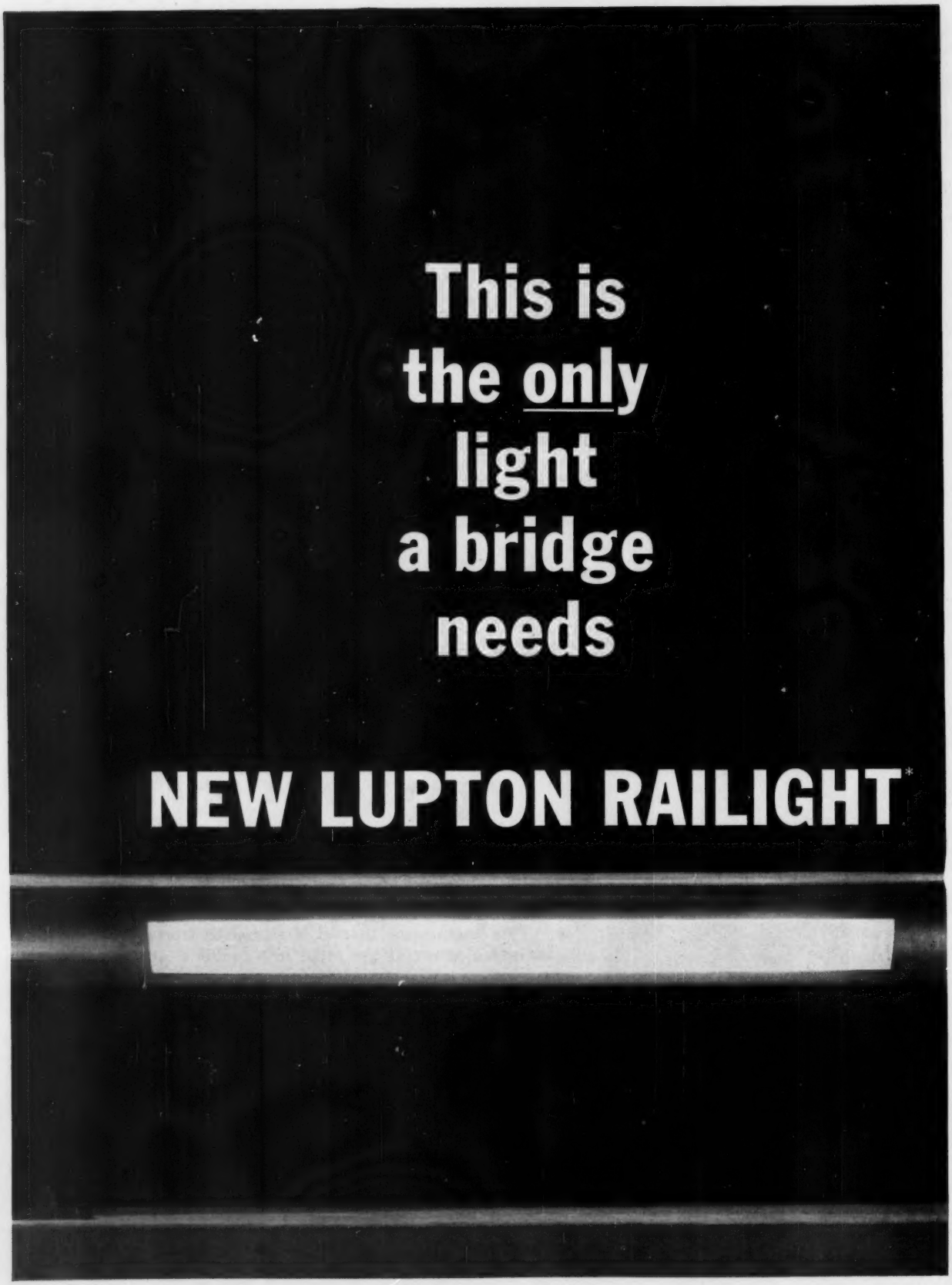
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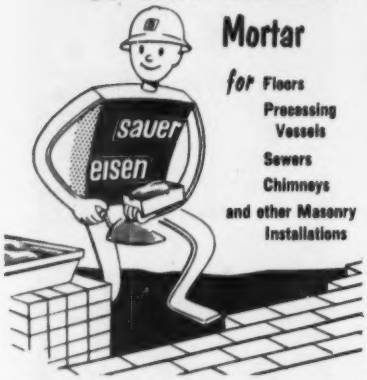

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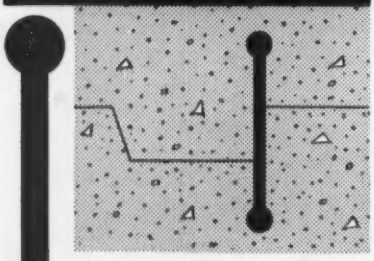

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Men in Engineering

Raymond J. Desmarais, formerly City Engineer and Commissioner of Works for the City of Windsor, has been appointed engineer in charge of the new Windsor office of the consulting engineering firm of M. M. Dillon and Company Limited. The firm also has offices in London (Ontario), Toronto, and Ottawa.

Announcement also has been made that John R. Crosby has joined the firm as traffic engineer. Crosby formerly was traffic engineer for the New Jersey Turnpike Authority.

The firm of Broyles, Bynum & Doyle, Inc., Baytown, Texas, has changed its name to Broyles & Associates, Consulting Engineers.

To provide improved service to clients in southern states, Continental Technical Service, Inc., Dayton, Ohio, has opened a local engineering office at 408 Drummond Road, Huntsville, Alabama. Lloyd C. Flatt, Continental's project aerodynamicist on assignment at the Redstone, Alabama, missile center, is in charge of the office.

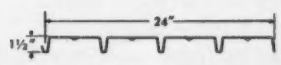
At their recent annual meeting, the stockholders of Albert Kahn Associated Architects and Engineers, Inc., Detroit, re-elected their seven-man board of directors for the ensuing year. The board members are: George H. Miehls, Sol King, Sheldon Marston, G. K. Scrymgeour, R. E. Linton, G. S. Whittaker, and V. C. Wagner. Executive officers re-elected by the directors are: George H. Miehls, chairman and treasurer; Sol King, president; Sheldon Marston, executive vice president; G. K. Scrymgeour, vice president and secretary; and R. E. Linton, G. S. Whittaker, V. C. Wagner, and Saul Saulson, vice presidents.

Due to the retirement of Hunter W. Hanly, senior partner of Hanly & Young, civil and structural engineers, of Cincinnati, Ohio, the firm has changed its name to Truman P. Young & Associates. Policies and activities of Hanly & Young are being continued with the same personnel, and obligations and credits of Hanly & Young have been assumed by the successor firm.

At the recent annual meeting of the board of directors of Capitol Engineering Corporation, Dillsburg, Pennsylvania, Charles M. Bingham was elected to the office of vice president. Bingham has been associated with the firm since 1951, most recently in the capacity of chief engineer of the highways and airfields divisions.

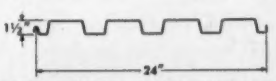
William A. McAlister has been elected president of the architect-engineering firm of Thomas J. Davis, Inc., following the affiliation of that firm with Engineering Service Corporation, civil engineers, of Los Angeles. In addition to managing the firm's Guam office in Agana, McAlister will direct the activities of Engineering Service Corporation in the Pacific Area. Prior to his promotion, McAlister

When it comes to roof systems, INLAND covers everything!



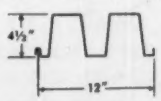
A-DECK — For purlin spacings not exceeding 8'4". Narrow ribs provide deck surface that supports the thinnest or softest type of insulation.

H-DECK — New! For simple spans from 10'0" to 20'0" — 3 and 4½" depths. Especially practical to cover walkways in shopping centers, schools, other installations.

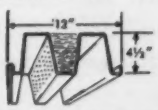


B-DECK — For spans to 10'0". Wide rib distributes metal for greater structural efficiency — gives higher section properties per pound of steel — well suited for use as side wall panels.

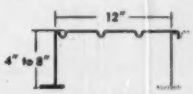
B-ACCOUSTIDECK — Two-in-one panel combines steel roof deck with acoustical ceiling having Noise-Reduction Coefficient of .70 — used for spans to 10'0".



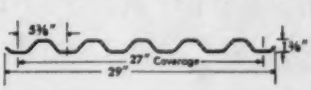
C-DECK—Carries normal roof loads over spans up to 24'0". Used extensively in canopies.



C-ACOUSTIDECK — Offers same Noise-Reduction Coefficient as B-Acoustideck. Can be used for spans to 24'0".



T-STEEL — New! Galvanized only — for clear spans to 32'0". Adaptable to acoustical and flush, luminous ceiling treatments. Provides superior diaphragm to transmit seismic and wind loads.



RIBFORM — High tensile galvanized steel form for concrete slabs over spans up to 8'0". Three types: Standard, Heavy-Duty, Super-Duty.

Whether your design calls for a dry insulation board roof or for wet-fill, there's an Inland roof system for the job — by the makers of famous Milcor steel building products.

Inland steel deck weighs less than half as much as poured-in-place or pre-cast construction. You can space joists wider and use lighter framework, to save both time and money. Panels are easy to handle and weld in place — in any weather that a man can work.

Types A, B, C, and H decks have the additional advantage of a Bonderized, baked-enamel prime finish that resists on-the-job damage. One field coat of paint on these Inland decks usually covers.

Write for catalogs 240, 241, and 245 — or see Sweet's sections 2c/Inl, 11a/In, and 2a/In.

member of the INLAND steel family

ENGINEERED PRODUCTS DIVISION

INLAND STEEL PRODUCTS COMPANY

Dept. F, 4149 West Burnham Street
Milwaukee 1, Wisconsin EP-1A

ATLANTA, BALTIMORE, BUFFALO, CHICAGO, CINCINNATI, CLEVELAND, DALLAS, DENVER, DETROIT, KANSAS CITY, LOS ANGELES, MILWAUKEE, MINNEAPOLIS, NEW ORLEANS, NEW YORK, ST. LOUIS

200-AMPERE CAPACITY

IN THIS SIZE

Whether you're interested in service entrance equipment or a safety switch, you need look no farther than this newest Heinemann circuit breaker unit.

Far smaller than comparably-rated fused pull-outs, it carries a big 200-ampere load—consistently, without any allowances for ambient temperature. De-rating—or any form of temperature compensation—is simply unnecessary. The breaker is magnetically actuated; there's not a thermal element to be found. You can put this equipment next to heat lines, or inside a snow bank; it will always carry full-rated current, always trip as specified.

And it's easy to install. Wiring space is plentiful. So are knockouts (you can run-in conduit from any angle). Solderless screw-type connectors are another time-saver.

Rated at 120/240V AC, two- or three-wire service, this unit is available with indoor or raintight, tamperproof outdoor enclosures. Either way, it costs less than what you are used to paying for fused equipment with 200-ampere capacity after de-rating.

For full information send for Bulletin 1003

HEINEMANN ELECTRIC COMPANY

127 PLUM STREET **TRENTON 2, N. J.**

was vice president in charge of sales and engineering.

Michael H. Barrett has been named an associate of Ketchum, Konkel and Hastings, consulting engineers of Denver, Colorado. In his new post, Barrett will supervise the structural models laboratory set up by the firm in 1959.

John P. Rossie, principal design engineer of the Columbus, Nebraska office of R. W. Beck and Associates, has become a partner of the firm with title of executive engineer. Willard H. Reuss, also a partner of the firm, will continue to be executive engineer in charge of the analytical department of the Columbus office. The firm also has offices in Seattle, Washington.

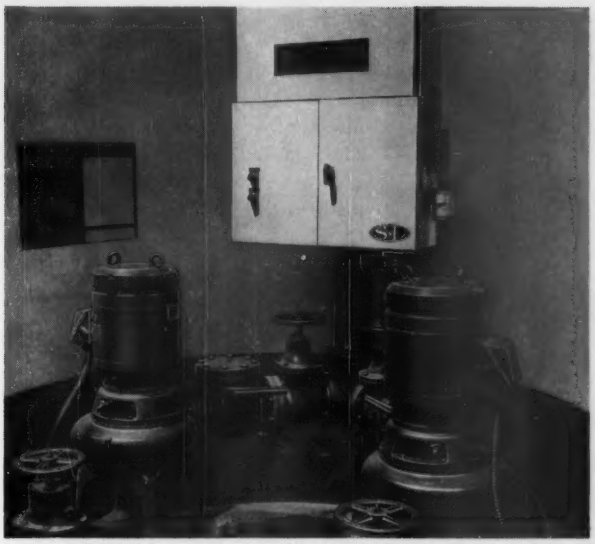
New address of Wiggs Walford Frost & Lindsay, consulting engineers, is 3285 Cavendish Boulevard, Montreal 28, Quebec.

T. K. Kutay has been appointed vice president and a member of the executive committee of Daniel, Mann, Johnson & Mendenhall, Los Angeles, California.

William L. Sheets, vice president of Stone & Webster Engineering Corporation, has been named senior construction manager of the firm. In his new capacity, Sheets will be responsible for the administrative direction of all construction department activities.

New address of Ciorba, Spies & Gustafson, consulting engineers, is 742 Twelfth Street, Wilmette, Ill.

William B. Hudson, Jr. has been elected vice president in charge of refinery engineering for Arthur G. McKee and Company, Cleveland engineering and construction firm. In this capacity with McKee, Hudson will be responsible for estimating and for the process and mechanical design of petroleum refineries, chemical, and petrochemi-



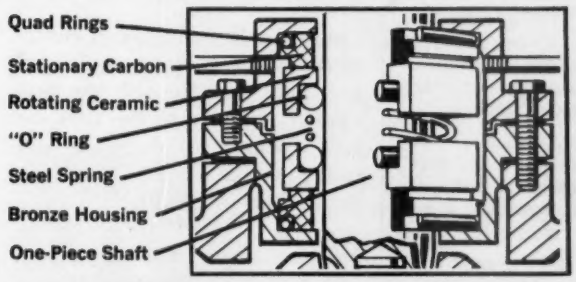
"BUILT FOR THE SMITH & LOVELESS PUMP STATION TO MAKE OUR PUMP STATION BETTER BUILT."

The One Pump Designed to Meet All the "Must" Requirements for Sewage Service

The Smith & Loveless "Non-Clog" sewage pump is the result of years of experience with over 1,400 varied pump station installations.

Ultimate in design and construction, the "Non-Clog" pump is precision manufactured of superior materials—with over-size shaft and bearings. Special attention is given to corrosion and abrasion resistance and ease of maintenance. Maximum pump efficiencies with ability to handle 3" solids.

Designed with close tolerances: shaft runout held to .003", shaft end play held to .010" and vibration movement to .005".



The Advantages of the Mechanical Seal...

Smith & Loveless experience in the sewage lift station field has proved the merits of "dead tight" mechanical seals. The double mechanical seal system in the Smith & Loveless "Non-Clog" sewage pump is the most satisfactory way to prevent sewage, noxious and dangerous gases from entering the pump room.

The mating surfaces of the long-wearing carbon and diamond-hard ceramics are lapped to a flatness tolerance of one light band to insure a liquid and gas-tight seal.

For further information, write for new Bulletin 500-A
Address: Department 120.

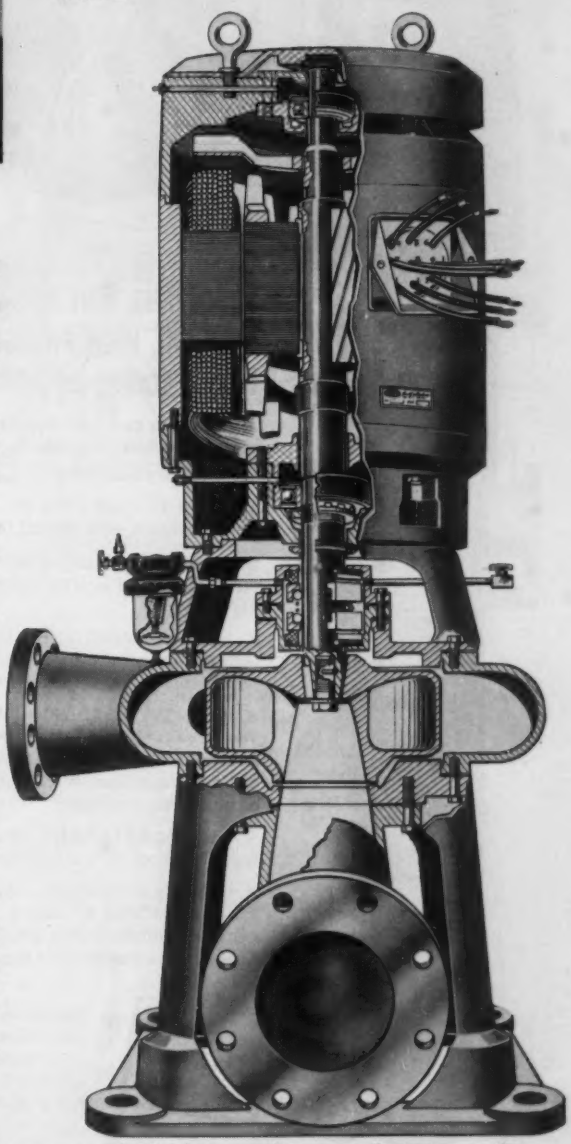
Smith & Loveless

VERTICAL CLOSE-COUPLED

"Non-Clog"

SEWAGE PUMPS

Built to the most exacting requirements by the world's largest manufacturer of factory-built sewage lift stations.



A superior pump for a superior pump station.

(3469)

S&L *Smith & Loveless*

DIVISION-UNION TANK CAR COMPANY
P. O. BOX 8884
KANSAS CITY 15, MISSOURI
Plant: Lenexa, Kansas

6 REASONS WHY JOHNSTON VERTICAL HIGH PRESSURE PUMPS HAVE BECOME SO POPULAR

Many uses: **as suction boosters, in power plants, pipe lines, refineries, for bulk plant transfer, in municipal booster service.**

1. SPACE SAVING—You get 3 times the capacity in ⅓ the space, with vertical Johnstons.

2. LESS DOWN TIME—Johnston verticals are designed for trouble-free operation with long-life expectancy.

3. LONG BEARING LIFE—In vertical Johnstons, thrust is taken up in the motor bearings, not in the pump, eliminating a frequent trouble source.

4. NON-OVERLOADING—Johnston high-pressure verticals have both a flat horsepower curve and steep head-capacity characteristic, making for economy and safe operation. With a Johnston, there is no danger of an overload.

5. EASY CONNECTIONS—It's easier to make piping connections with a Johnston vertical.

6. GREATER EFFICIENCY—Johnston's accommodate variations in head by staging, as well as by trimming the impellers, thus giving much greater efficiency over a vastly wider range.

Pressures over 1,000 psi.
Capacities to 12,000 gpm
Temperatures to 600°F.

For complete details talk to your nearest Johnston distributor or write direct to the factory for colorful "Type C Industrial Pump" bulletin.

Versatile Verticals by...

JOHNSTON PUMP COMPANY

A DIVISION OF THE YOUNGSTOWN SHEET AND TUBE COMPANY

3272 E. Foothill Blvd., Pasadena, Calif.

cal plants. The position formerly was held by F. Drake Parker who is presently acting as managing director of McKee Head Wrightson, Limited, in London.

Announcement also has been made of the appointment of Edwin G. Graeber as technical director in charge of process engineering for the firm's refinery division. Graeber replaces Luther R. Hill who has resigned.

V. P. Victor, M. E., consulting engineer, has moved his office to 150 Nassau Street, New York 38, N. Y.

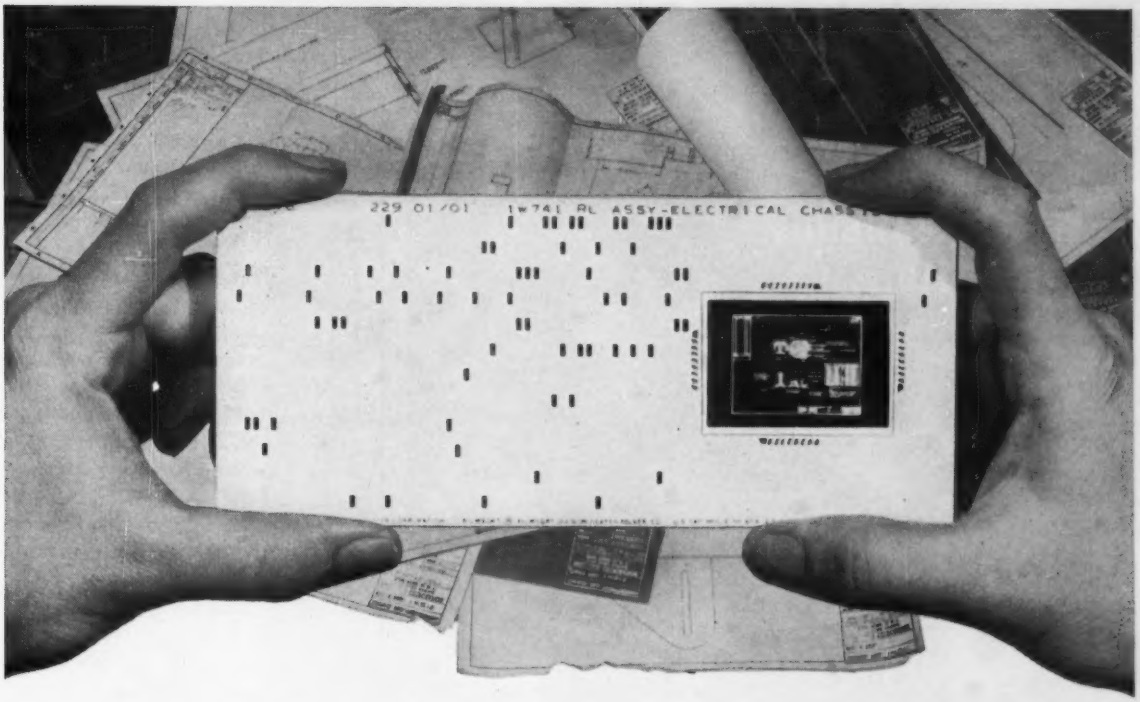
Walter F. Oleksiak has been elected to the newly created post of vice president-construction of United Engineers & Constructors Inc., Philadelphia. Oleksiak has been with the firm since 1941 and has held various construction posts, including that of construction manager since 1958.

United Engineers & Constructors Inc. also has named Thomas M. Dahl manager of the firm's Chicago office. Formerly new business representative in the midwest region, Dahl will continue to have offices in Chicago.

Judson G. Hyde has been elected to the board of directors of Burns and Roe, Inc. He also has been elected treasurer of the firm and will continue his duties as controller and director of the company's Finance Division.

Johannessen and Girand, consulting engineers, Phoenix, Arizona, has announced the appointment of three new vice presidents. They are: Ben T. Dibble, civil engineer; Andrew Krafczyk, electrical engineer; and Arthur W. Tesmer, mechanical engineer.

Ben W. Young has joined the firm of T. Y. Lin and Associates, consulting structural engineers, and following an intensive training period at the company's headquarters at Van Nuys, California, will



All the accuracy of original drawings but none of the "headaches"

New RECORDAK Precision Drawing System reproduces your drawings as needle-sharp images with remarkably uniform backgrounds on low-cost 35mm RECORDAK microfilm.

Mounting these frames in Filmsort aperture cards provides an *active* drawing file that speeds reference, cuts printmaking costs, ends drawing wear-and-tear.

With decks of cards instead of bulky drawing files, you'll save time *every time* you refer to drawings, and when you need prints. Drawings can be kept at the finger tips instead of "far away"—instantly available for viewing in a Recordak film reader.

This greatly reduces need for reference blueprints. And it makes reference, itself, so much easier. For your microfilmed drawings stay clean and sharp—no smudging or loss of detail from handling or printmaking.

Easy to get paper prints and duplicate film copies

When, for any reason, you do want paper copies, reduced-size prints can be made fast—directly from the microfilm aperture card—by low-cost photographic, xerographic or electrostatic methods. Duplicate "microfilm cards" also can be made for branches, vendors, government agencies for pennies apiece.

Free booklet gives additional facts on this Recordak system available through Recordak and its nation-wide dealer organization.

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Gentlemen: Send free booklet describing new RECORDAK Engineering Drawing System. No obligation whatsoever.

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originator of modern microfilming
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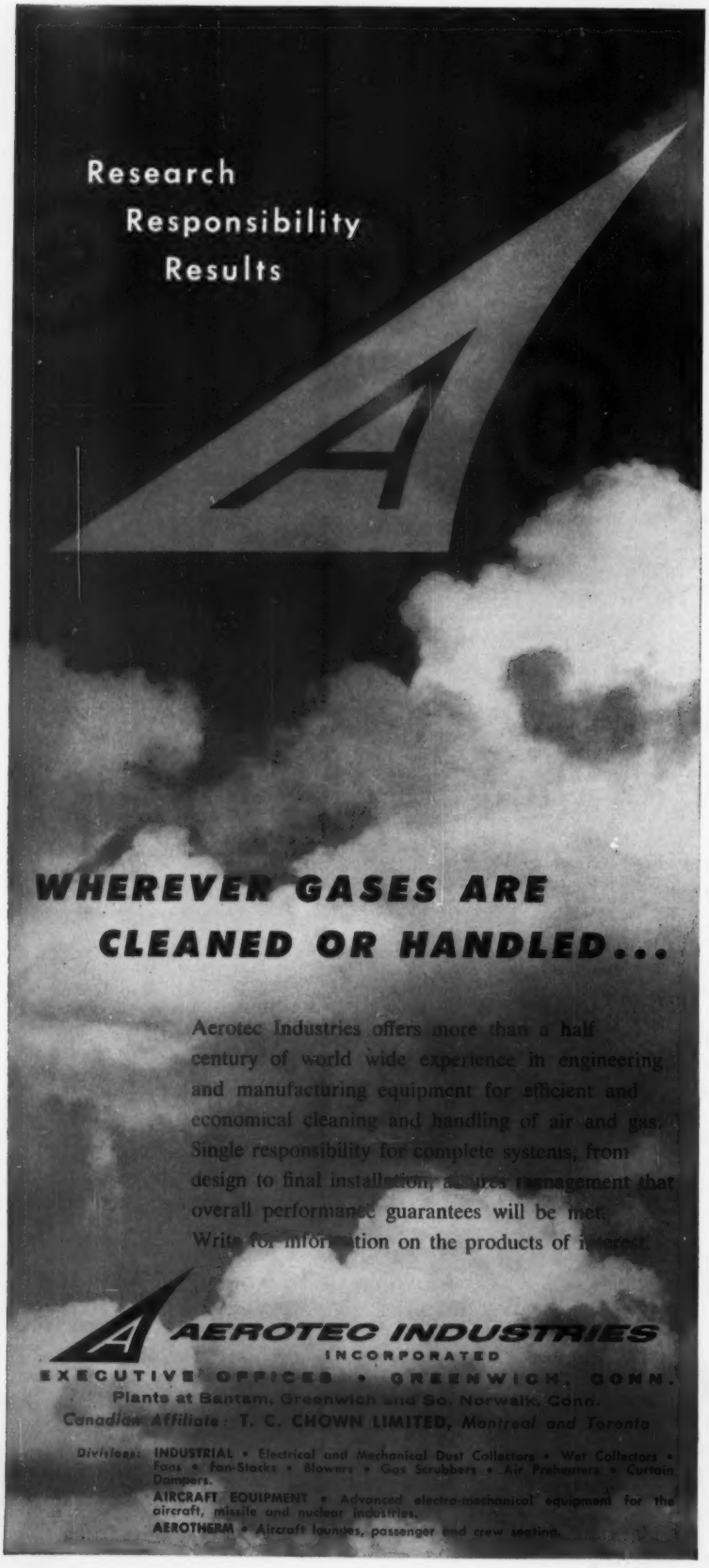
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Responsibility
Results
WHEREVER GASES ARE
CLEANED OR HANDLED...
Aerotec Industries offers more than a half
century of world wide experience in engineering
and manufacturing equipment for efficient and
economical cleaning and handling of air and gas.
Single responsibility for complete systems, from
design to final installation, assures management that
overall performance guarantees will be met.
Write for information on the products of interest.
AEROTEC INDUSTRIES
INCORPORATED
EXECUTIVE OFFICES • GREENWICH, CONN.
Plants at Bantam, Greenwich and So. Norwalk, Conn.
Canadian Affiliate: T. C. CHOWN LIMITED, Montreal and Toronto
Divisions: INDUSTRIAL • Electrical and Mechanical Dust Collectors • Wet Collectors • Fans • Fan-Stacks • Blowers • Gas Scrubbers • Air Preheaters • Curtain Dampers.
AIRCRAFT EQUIPMENT • Advanced electro-mechanical equipment for the aircraft, missile and nuclear industries.
AEROTHERM • Aircraft lounges, passenger and crew seating.

head the firm's southeastern area branch office, located at 528 Interurban Building, Dallas, Texas.

Raymond Itaya also has joined the staff. He formerly worked with the California Division of Highways and the Division of Architecture as a structural engineer.

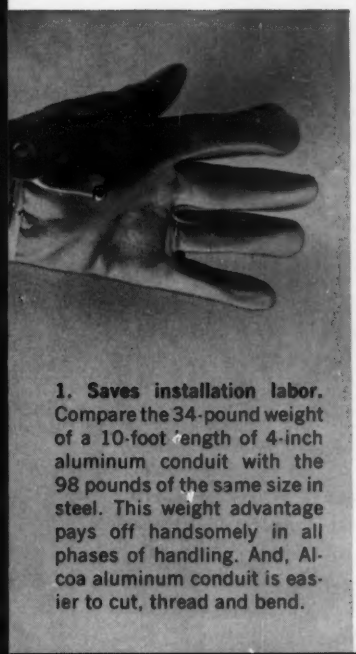
James L. Breese, well known New Mexico consulting engineer, has become chief engineer of Eagleson Engineers, of San Francisco, California. Breese formerly headed his own firm in Santa Fe and was president of the Consulting Engineers Association of New Mexico.

Two recent elections have been announced by Marc Shiowitz and Associates, Inc., electronic engineering consultants, Hawthorne, California. Vernon D. Walker, a vice president of MS&A since 1958, has been elected chairman of the board of directors and senior vice president. James F. Hudson, formerly director of systems engineering, has been elected vice president-engineering.

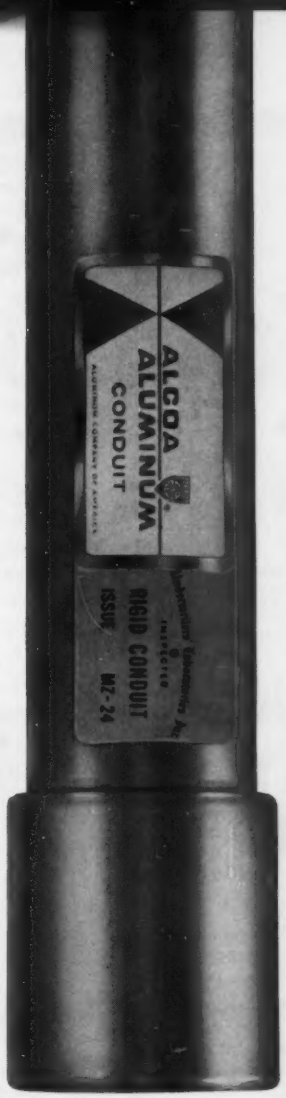
Also Dr. Lloyd L. Philipson has been appointed director of advanced planning of MS&A.

Dr. Ing. P. Walter, consulting engineer, Essen, Germany, and G. Bory, consulting engineer, Paris, France, have set up a joint German-French consulting engineer firm which will direct its efforts primarily toward engineering work within the Common Market area and the Common Market area of influence in Africa, the Middle East, and Asia. This is the first German-French engineering office to be organized for operation within the European economic community. Dr. Ing. P. Walter has been a well known consulting engineer in Germany for many years, with an office in Essen and an office managed by his son, Dipl.-Ing. Hans Walter, in Koln. Dr. Walter has personally served as president of the German Association of Consulting Engineers and

5 good reasons for specifying Alcoa aluminum electrical rigid conduit



1. Saves installation labor. Compare the 34-pound weight of a 10-foot length of 4-inch aluminum conduit with the 98 pounds of the same size in steel. This weight advantage pays off handsomely in all phases of handling. And, Alcoa aluminum conduit is easier to cut, thread and bend.



2. Appearance. With aluminum conduit you can forget staining of adjacent surfaces. Under normal conditions, there's no painting needed, because aluminum's natural good appearance is inherent.

3. Resists corrosion. This seamless extruded conduit stands up to most corrosive environments. It requires no galvanizing or other protective coating. Even in food processing plants it needs no paint.

4. Electrical advantage. Aluminum's low impedance, due to its nonmagnetic characteristic, coupled with its high electrical conductivity provides greater protection against ground-fault hazards. Phases may be separated and run in individual nonmagnetic aluminum conduit.

5. Over-all costs. Compare first cost of Alcoa aluminum conduit with steel conduit. Then consider the installation and maintenance savings, and the long-range value of aluminum really shows to advantage.

Get all the facts and figures in time for your next job. Contact your electrical distributor or one of our representatives. Or drop us a line for free literature. Write to Rome Cable Division of Alcoa, Dept. 7-80, Rome, New York.

ROME CABLE
DIVISION OF **ALCOA**

KRALOY PVC RIGID CONDUIT before encasement in concrete slab. Its mirror-smooth interior walls make fishing easier.

ABSOLUTELY NO CORROSION, LOW COST INSTALLATION, WITH KRALOY PVC RIGID CONDUIT

Continuing research and laboratory quality control – plus U/L listing*– have made KRALOY PVC RIGID CONDUIT a major advancement in electrical raceways. Not affected by rust, rot, pitting or soil electrolysis, KRALOY PVC CONDUIT has properties that make it the *preferred* conduit. Precision-extruded, corrosion-proof KRALOY is non-magnetic, non-sparking, *won't support combustion.* Its mirror-smooth walls make fishing easier – and its amazing light weight (approximately 1/6 the weight of steel, 1/2 that of aluminum) makes its easier to carry, handle and install. KRALOY PVC CONDUIT needs no threading, can be cut easily and joined by a simple solvent weld. It never needs painting or coating. And contractors report that installation costs are cut as much as 20% with KRALOY PVC on the job. If you'll consider KRALOY'S trouble-free characteristics and the money that can be saved in installation, you'll specify KRALOY PVC CONDUIT on your next job. Send the coupon today for the full story on KRALOY – the *first* and *only* PVC conduit with U/L listing*!

NOTE THESE WEIGHT COMPARISONS (LBS.)

Trade Size	½"	1"	2"	3"	4"	5"	6"
KRALOY PVC	**15.0**	**29.0**	**63.0**	**131.0**	**187.0**	**253.0**	**326.0**
ALUMINUM	27.4	53.0	115.7	238.9	340.0	465.4	612.9
STEEL	79.0	153.0	334.0	690.0	982.0	1334.0	1771.0

Kraloy Plastic Pipe Co., Inc., Dept. CE-6
402 West Central Avenue, Santa Ana, Calif.

Gentlemen: Please send me your new Brochure on KRALOY PVC CONDUIT which gives complete information and installation directions.

Name_____

Address_____

City_____ Zone____ State_____

KRALOY PVC CONDUIT is sold only through wholesale electrical supply houses.

NO CONDUIT REPLACES **KRALOY**

*For direct underground burial or encased in concrete.

is currently on the board of directors of the International Federation of Consulting Engineers (FIDIC). George Bory's office in Paris also has been prominent. Bory has been officer of the French Association of Consulting Engineers, and he currently is vice president of FIDIC. The Paris office is at 80, Quai du Marechal-Joffre and the Essen office is at Bismarckstrasse 5.

Richard Elstner has become an associate member of The Engineers Collaborative, consulting structural engineers, of Chicago. Elstner formerly was structural development engineer at the Portland Cement Association Research and Development Laboratories in Skokie, Illinois.

At the formal convocation last month of the Spring Arts Festival at Bethany College in West Virginia, the honorary degree of Doctor of Fine Arts was conferred upon David B. Steinman, bridge engineer of New York City. This degree brings Dr. Steinman's total to 25 and is in recognition of his achievements as a poet and as a builder of beautiful bridges.

A group of leading nuclear engineers and scientists have formed a new technical service organization called Nuclear Utility Services, Inc., to help electric utility companies plan and operate nuclear power plants. Headquarters of the company are located at 1518 K Street, N. W., Washington, D. C. Principal officers of the firm are Frederick H. Warren, chairman of the board; John E. Gray, president and chief executive officer, and Dr. Warren F. Witzig, vice president and technical director.

Associated with the firm as senior technical consultants are other prominent scientists including Dr. Manson Benedict, head of the Department of Nuclear Engineering, MIT; N. J. Palladino, head of the Nuclear Engineering

update your specs

ON

G-B GLASS FIBER INSULATIONS

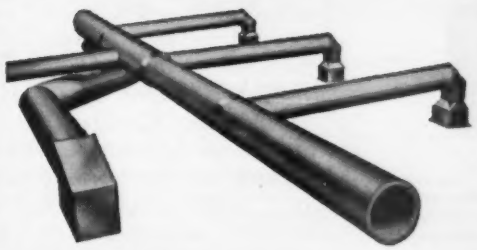
Technical bulletins on the Gustin-Bacon glass fiber insulations shown here, including complete specifications, have been revised and reprinted from time to time. To be sure your literature file is up-to-date, simply fill in the coupon below, check the information you need, and mail.

G-B SNAP*ON® pipe insulation

Second to none in insulating efficiency among all general purpose pipe insulations is G-B SNAP*ON — the original one-piece pipe insulation molded of fine glass fibers. In one simple motion G-B SNAP*ON snaps over cold or hot lines up to 350°, indoors or out, to provide truly efficient and permanent thermal protection. Check **G-B SNAP*ON Brochure** in coupon below.

G-B ULTRALITE®
for duct wrap and lining

For life-long thermal efficiency, try ULTRALITE —the original insulation made of long, **strong** textile-type glass fibers. As a duct liner (right), ULTRALITE puts an end to objectionable cross-talk and air rush noises . . . never flakes off into the air stream. And its coefficient of friction is essentially the same as bare sheet metal. Uniformly thick ULTRALITE duct insulation (left) provides full insulating efficiency at rock-bottom costs. For further information, check **ULTRALITE Duct Liner & Insulation Brochure** in coupon below.



new "prefab"
glass fiber duct — G-B DUCT

G-B DUCT — the round, prefabricated duct made entirely of glass fiber insulation — absorbs cross-talk noises usually associated with air conditioning systems in motels, medical centers, retail stores, etc. G-B DUCT is high in thermal efficiency, too! Just check **G-B DUCT Brochure** in coupon at right for further information.

CHECK BROCHURE DESIRED

- ☐ G-B SNAP*ON BROCHURE
- ☐ ULTRALITE DUCT LINER & INSULATION BROCHURE
- ☐ G-B DUCT BROCHURE

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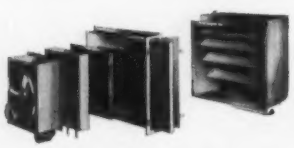
GUSTIN-BACON Mfg. Co. gb

212 West 10th St., Kansas City, Mo.

Thermal and acoustical glass fiber insulations . . . Molded glass fiber pipe insulation . . . Couplings and fittings for plain and grooved end pipe.

Your best investment in modern air-handling equipment! New Aerovent Air Make-Up Units provide clean, fresh air in winter or summer; help maintain uniform temperature levels throughout working areas. Used as filtered-air supply units or air preheaters, these versatile units permit heating and ventilating systems to operate at design efficiency; equalize negative pressures by replacing exhaust air.

Steam, hot water or gas-fired models in sizes 18" to 54" (larger units available on order) for capacities, pressure conditions and BTU ratings to suit your requirements. Compact, packaged design for roof or wall mounting. Other assemblies also supplied for exclusive use in air supply or air heater applications. Why not investigate the many advantages of these high-efficiency units, today?



STEAM OR HOT WATER

Furnished in 7 unit arrangements in sizes 24" to 54". Capacities from 5,000 to 35,000 CFM. Roof or wall types for all requirements.

GAS-FIRED

Supplied in 4 unit arrangements for roof or wall mounting. Sizes 36" to 54" for various capacities, BTU ratings and pressure conditions.

Write for new Bulletin 880

Air deliveries of all Aerovent equipment are tested and rated in accordance with established and accepted codes and each unit is guaranteed by the manufacturer to deliver its rated performance.

CERTIFIED PERFORMANCE

Aerovent FAN COMPANY, INC.

Ash and Bacon Streets — Piqua, Ohio

Department, Pennsylvania State University, and formerly manager of the Reactor Design Subdivision of the Shippingport project; and Dr. Stuart McLain, formerly associate director of Argonne National Laboratory.

Richard H. Tatlow III, president of Abbott, Merkt and Company, consulting engineers of New York, is listed as a member of the company's board of directors.

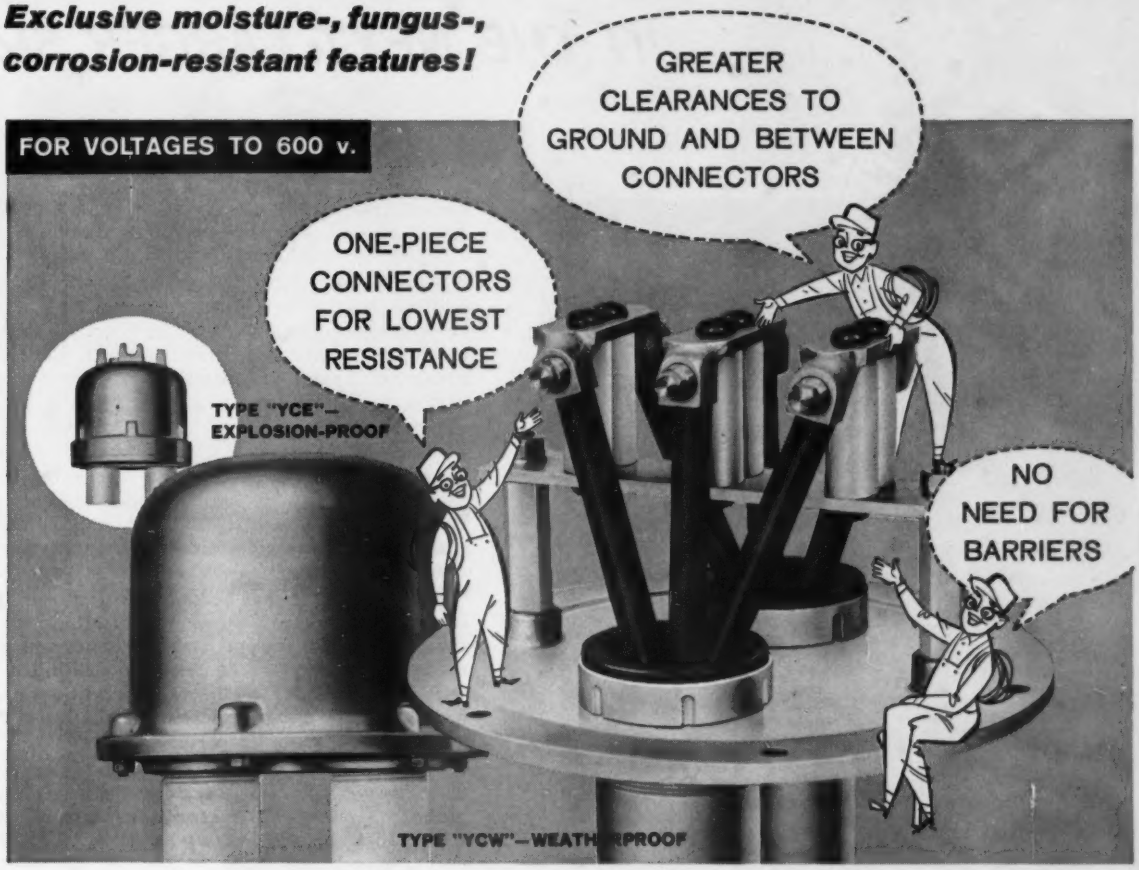
Among the services the company is prepared to render are counsel on the choice, purchase, and utilization of nuclear fields; advice on the operation and maintenance of nuclear power plants including the disposal of radioactive wastes; and assistance on the technical and managerial problems which are peculiar to the nuclear power industry, such as evaluating and planning nuclear sites and choosing nuclear power plant designers and contractors.

George M. Rust has been elected executive vice president and J. Bolling Sullivan, Jr. and John W. Clark, vice president of The Rust Engineering Company, Pittsburgh, Pennsylvania, with their headquarters at Birmingham, Alabama.

S. L. Stolte, a partner in the architectural and engineering firm of Bettenburg, Townsend, Stolte and Comb, St. Paul, Minnesota, has received the first annual award for Minneapolis urban renewal and redevelopment. Purpose of the award, sponsored by the Minneapolis Area Chamber of Commerce in cooperation with The Sperry and Hutchinson Company, is to offer recognition and some tangible reward for the "many citizens who have spent untold hours of their own time on the task of making Minneapolis a better place to live, work, and do business." Stolte has been chairman of the Minneapolis Housing and Redevelopment Authority for the past eight years, in addition to numerous other posts. ▲▲

NEW! O.Z. PULL-N-SPLICE BOXES!
CONVENIENT·COMPACT·ECONOMICAL

Exclusive moisture-, fungus-, corrosion-resistant features!


FOR VOLTAGES TO 600 v.
GREATER CLEARANCES TO GROUND AND BETWEEN CONNECTORS
ONE-PIECE CONNECTORS FOR LOWEST RESISTANCE
TYPE "YCE"— EXPLOSION-PROOF
NO NEED FOR BARRIERS
TYPE "YCW"—WEATHERPROOF

O.Z. Pull-n-Splice Boxes mark a significant advance in pull box construction!

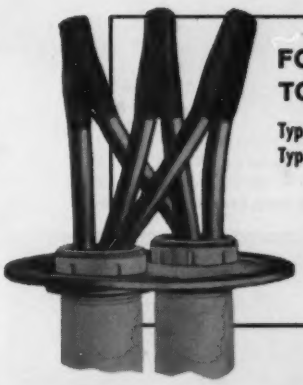
Their highly compact size saves *more space than ever!*

Their more efficient design means *new savings in installation time and labor!*

Their moisture-, fungus-, and corrosion-resistant features mean long, trouble-free service.

Still, with all their features, the new O.Z. Pull-n-Splice Boxes are *smaller* — and *cost far less* than conventional pull boxes . . . even late model *competitive* types! And, you get a bonus in high quality materials and workmanship so characteristic of *all* O.Z. products!

For complete information on these and the many other O.Z. products that mean more for you, call your local O.Z. distributor, or write to the company.



FOR VOLTAGES TO 5000 v.

Type "YPW" — Weatherproof
Type "YPE" — Explosion-proof

Deeper dome than "YCW" and "YCE". Furnished without connector panels. Insulated pigtail splices recommended.

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...IN THE NEXT LARGER SIZE

Leading architects and builders with an eye to future electrical expansion recommend . . . *make every wiring installation bigger than it has to be NOW!*

With Republic ELECTRUNITE® Electrical Metallic Tubing in the next larger size over minimum requirements, you power up today, yet provide for tomorrow's greater electrical loads. All, at no greater cost than with threaded type conduit!

ELECTRUNITE provides a pull-in, pull-out grounded wiring system which if extra-capacity is specified can be expanded simply by adding or replacing wire. No need to tear out walls or ceilings. No ripping up floors. And, the installation economies of Republic "INCH-MARKED"® E.M.T. make all this possible within the framework of the original financing.

Republic E.M.T. has been job-proved by millions of feet installed over the years. Installations made more than 25 years ago are still in service today, ready for more years of electrical flexibility. And with Republic E.M.T.—the *steel* conduit—you don't have to worry about concrete installations. Takes up less space, too.

Specify your conduit by name—Republic ELECTRUNITE E.M.T. Buy future capacity for tomorrow at today's costs. See your Republic representative, or send coupon.

Leonard V. Berg, Berg Electric, Rochelle, Illinois, says: "The installation advantages of ELECTRUNITE more than pay for themselves in savings of time." Mr. Berg was the electrical contractor for the two installations featured below.

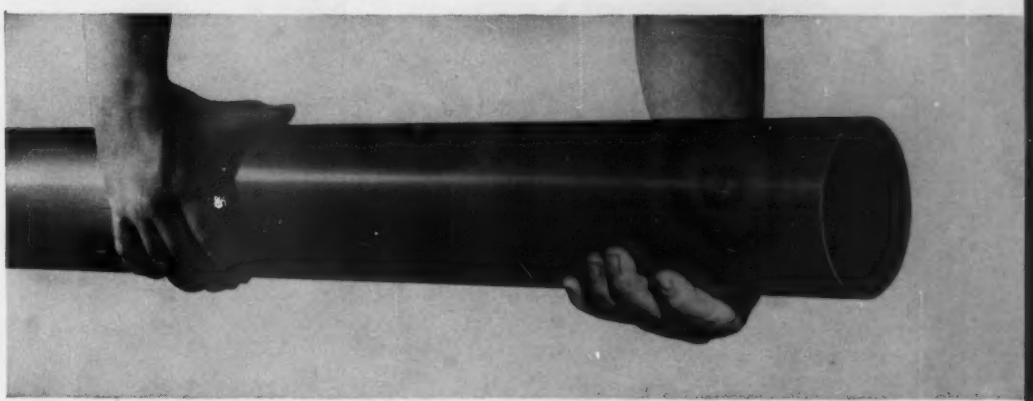
DeKalb Public Hospital, DeKalb, Illinois
General Contractors: Johnson & Jacobson, DeKalb, Ill.
Architect and Engineer: Gilbert A. Johnson, A.I.A., Rockford, Ill.
Electrical Contractor: Leonard V. Berg, Berg Electric, Rochelle, Ill.

Sycamore High School, Sycamore, Illinois
General Contractors: Johnson & Jacobson, DeKalb, Ill.
Architect and Engineer: Gilbert A. Johnson, A.I.A., Rockford, Ill.
Electrical Contractor: Leonard V. Berg, Berg Electric, Rochelle, Ill.

ERECTION SCHEDULES ARE EASILY MET or even shortened with Republic High Strength Structural Bolt Assemblies. Two-man teams replace costly erection crews. When wrenched up tight, Republic High Strength Bolts provide a vise-like clamping force which transfers loads by friction to the structural members. Fatigue life is improved. Joints are stronger than connections where loads are carried in shear. Send coupon for illustrated folder.

REPUBLIC ELECTRUNITE STRUCTURAL TUBING, available in both carbon and stainless steels in a wide range of sizes and wall thicknesses — rounds, squares, and rectangles, is a modern building material with unlimited freedom in design. Both beautiful and functional. Lightweight, easy to handle. Here, ELECTRUNITE Stainless Steel Tubing, 2″ x 2″ and 1¼″ x 1¼″ squares, were used for handrails and Newell Posts in this modern office building. For data and size range chart, write for Brochure SA-STR-60. Use coupon below.

REPUBLIC ANNOUNCES LIGHT WALL LINE PIPE! This newest kind of electric weld line pipe is available from Republic in 1.315″ through 4.500″ O.D. Save up to ⅓ in weight, ⅓ the cost. Of special interest for low pressure gathering and distribution applications. Republic Light Wall is manufactured to applicable parts of API Specification 5L. Light Wall Pipe is easily joined by welding or by light wall pipe fittings. Or, pipe may be grooved for Victaulic Couplings. Republic X-TRU-COAT can be supplied in all sizes of light wall pipe. Call your Republic representative or send coupon for complete information.



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☐ ELECTRUNITE Structural Tubing Brochure SA-STR-60

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Firm_____

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If you want to help clients cut maintenance costs, Herb Norton's a good man to talk to. A member of Du Pont's recently formed Technical Service Group, Herb's a specialist whose job it is to solve maintenance painting problems of every description. In his words:

"The further maintenance dollars go, the greater the return on your clients' investment in plant and equipment. True costs, however, aren't determined solely by the price of the paint. To measure value accurately, you've got to take into account such factors as expense of application and length of time the paint job lasts. Believe me, it's false economy to start with anything but top-quality finishes. That's one reason Du Pont paints are so often specified.

"Another reason, equally important, is the expert guidance you get from Du Pont. You see, we go right into your client's plant or installation and make a thorough study of his individual maintenance problem. Then—drawing on our own experience, backed up by Du Pont technical competence—we formulate a painting program that meets his needs exactly. Service like this helps you achieve, for *your* clients, lasting protection against every conceivable corrosive condition, *at lowest cost per square foot per year.*"

If you have a maintenance problem you'd like to discuss with an expert, there's a man like Herb Norton in *your* area. To meet him, just call your nearest Du Pont district sales office. Or write: E. I. du Pont de Nemours & Co. (Inc.), Finishes Division, Dept. CE-66, Wilmington 98, Delaware.

* * *

Herbert L. Norton came to Du Pont's Finishes Division in 1939, having studied chemical engineering at the Georgia School of Technology. As he added experience, increased responsibilities kept pace. Currently, Herb is Southeastern District Manager, Industrial Maintenance Sales. His background includes problem-solving in such areas of industry as textile, paper, petroleum, food, marine and public utilities.

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BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

Reporting
The New Projects

Electronic Monorail for Department Store

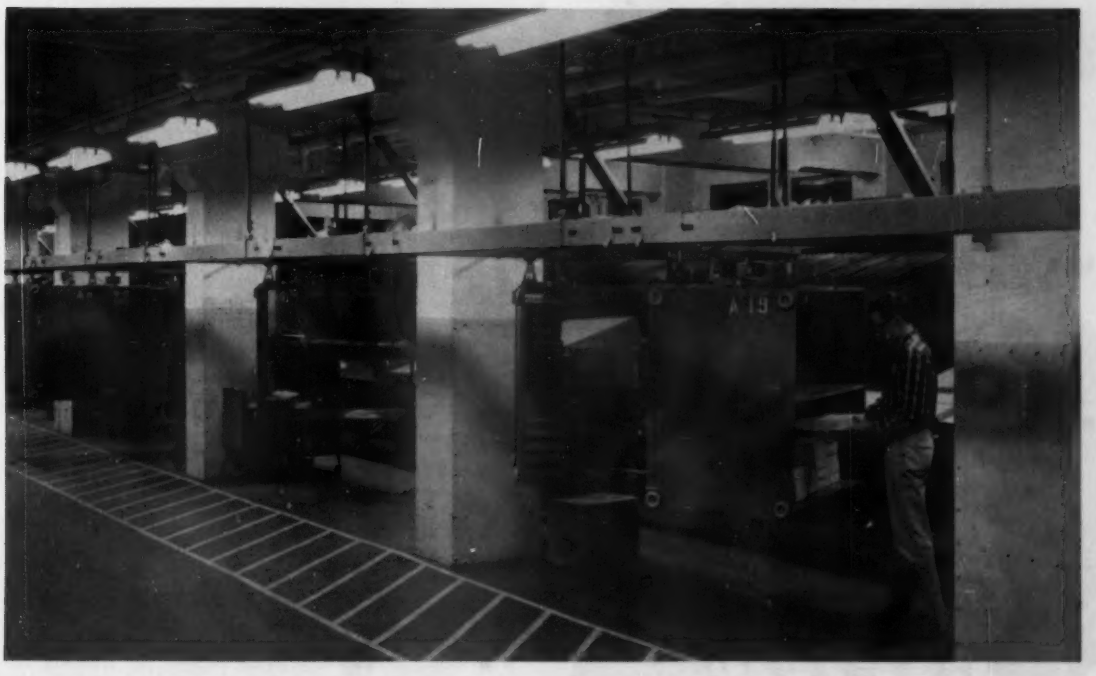
One of the first electronically controlled monorail systems in a department store now is operating at Famous-Barr of St. Louis. Designed by Richard D. Elwell, consulting engineer of East Rockaway, New York, the system uses a Columbus McKinnon Power-Flex conveyor system equipped with special carriers and Telematic dispatch heads.

The monorail system begins in a service building located a block away from the store itself. Merchandise travels through a tunnel to the store, with an automatic lift system raising or lowering carriers to and from the tunnel. A simple dial system on each carrier is used to direct it to its proper destination. Returning empty carriers are accumulated on a nonpowered section of the monorail.

In addition to the monorail, an Alvey Conveyor Company system is used to move cartons of material from the shipping dock to the proper check point in the service building. This system includes a roller conveyor, pusher bar conveyor, and flat belt conveyor with deflecting bars controlled by the dispatcher at a switchboard.

Iron Chains Brace Old Shaft

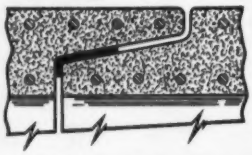
During the reconstruction of London's Wapping subway station, an iron chain was found circling the shaft housing pedestrian stairways. This is one of the original shafts on the world's first underriver tunnel (see CONSULTING ENGINEER, December 1959), and it is assumed that the chain was used



Electronic control head on monorail system carriers allows operator to manually dial desired destination.

TYLOX "C"
Rubber PIPE GASKETS

. . . provide visual proof of correct pipe coupling



TYLOX "C" Gasket under full compression. Note the visual inspection feature.

Hamilton Kent Type "C" TYLOX Gaskets for concrete sewer pipe provide watertight joints at head pressures up to 50 feet. Gasket consists of base, multiple sealing fins and *inspection flange* which overhangs the edge of the pipe tongue, or alternately, the tongue offset, according to the type of pipe.

"C" Gaskets are of true compression type, made of either rubber or neoprene. They may be installed at the job site, or pre-assembled at the pipe manufacturer's plant. Compounded specially to resist sewerage and industrial waste acids, they never deteriorate. Under ground and under compression, TYLOX "C" Gaskets outlast the pipe itself. Write for brochure.

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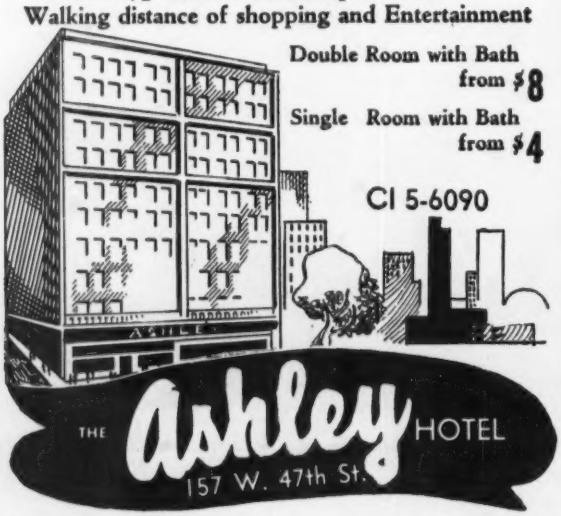


to help withstand stresses encountered in its original sinking during the early 1800s.

During the original construction, a cast iron ring was built on the surface and the brickwork of the

Iron chains bound the shaft of London's Wapping subway station, part of world's first under river tunnel.

shaft was laid on this to its full height of 42 feet. The ground inside the cast iron ring then was excavated, and the brick cylinder descended in one piece under its own weight.

According to contemporary accounts, the cylinder was rigidly braced to help it withstand the stresses involved. Thus, it is assumed that there are other chains, not discovered during the current construction work. The chain discovered is made up of 6-in. iron links, forged from 1¼-in. diameter bar. It was in good condition after over 120 years.

Warehouse to Office Building

The Pomeroy Building, located in one of San Francisco's most promising redevelopment areas, is a modern office building that belies its original function as a warehouse and ice plant. Not only does the converted building supply ample space for the consolidation of all operations of J. H. Pomeroy & Company, but also for a number of additional tenants. Comprising six stories and basement, the original concrete structure was completely changed, inside and out, to provide approximately 80,000 square feet of office area.

Because of the mild San Francisco temperatures, it was realized that the interior areas of the building would require year-around cooling. A unique heating system was developed when it was further realized that the heat removed from these areas was more than sufficient to supply the heating requirements of the exterior zones, even with outside

NEW for Schools...

PRACTI-CALL® ... the practical, all-purpose communication system

"Functionalism without Frills"

Telephone permits private, two-way communication.
Wall speaker provides for general announcements, special events, emergency instructions, etc.
Wiring is in same conduit as clock and program system.

PRACTI-CALL system is incorporated as part of clock and program system ... utilizes same conduit, existing bell control board (background) ... is operated by office secretary.

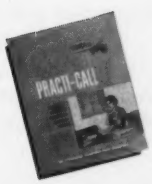
Here at last is an *economical, sensible* communication system designed especially for schools. PRACTI-CALL fills *all* school communication needs:

1. General announcements, news, special events, emergency instructions, etc. are communicated to all classrooms simultaneously through an "all call" speaker system.
2. Conversations requiring privacy (approximately 90% of all intra-school communication) are carried on over a private telephone system.

With all its flexibility of use ... an adaptability never before available ... PRACTI-CALL costs *substantially less.* No bulky, high cost console ... no intricate mechanisms to go awry.

IMPRESSIVE INSTALLATION SAVINGS—All basic wiring runs in the *same conduit* as the school's clock and program system ... effecting additional important savings on installation.

PIN-POINTED RESPONSIBILITY—Service, whether on clock and program system or communication system, is from a *single source* when PRACTI-CALL is specified with a STANDARD program system.



Request Bulletin No. 248 containing complete information and specifications.

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Since Symentard works by slowing down the rate of hydration, and not by entraining air, the proportions can be varied to meet job and climatic conditions. This means stronger, denser concrete that will have higher resistance to cracking.

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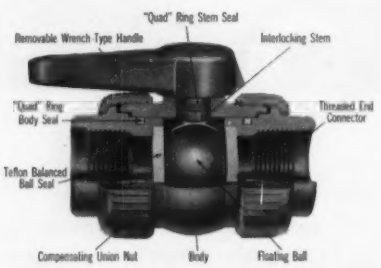


Fast-acting CHEMTROL ball valves CAN'T CORRODE!

Here's a complete line of plastic valves that *cuts replacement costs and downtime wherever acids, alkalies and many solvents are handled!* Made in 5 basic types of plastics; broad chemical resistance as well as good performance in high temperature ranges.

Compact Chemtrol ball valves feature ¼ TURN TO SHUT-OFF, FULL FLOW CHARACTERISTICS, NO TURBULENCE, CONTINUOUS TAKEUP ON REPLACEABLE SEATS, UNION TYPE END CONNECTORS, QUICK DISASSEMBLY!

Chemtrol is the LEADER in plastic valve manufacture!

ASK FOR CATALOG—Many valve types, widest size range in the industry. Dealers in all leading industrial areas.

CHEMTROL

404 West Central Avenue, Santa Ana, California

temperatures as low as 35 F. By using a simple device employing the heat pump principle, the heat removed from interior zones in cold weather is used to heat the exterior zones. To provide heat during periods when the building is unoccupied, a gas-fired water tube water heater is connected to the supply line to maintain the hot water at 95 F.

Lobby of the Pomeroy Building, a converted warehouse in the heart of a San Francisco redevelopment area.

Design figures for lighting in the converted building were three watts per square foot, with additional power for receptacle outlets for portable machines and localized lighting, plus elevators and air conditioning. The total connected load was 1200 amperes. Final electrical system design took into consideration a possible expansion to 1500 amperes.

Crude Stabilization Plant in Sahara

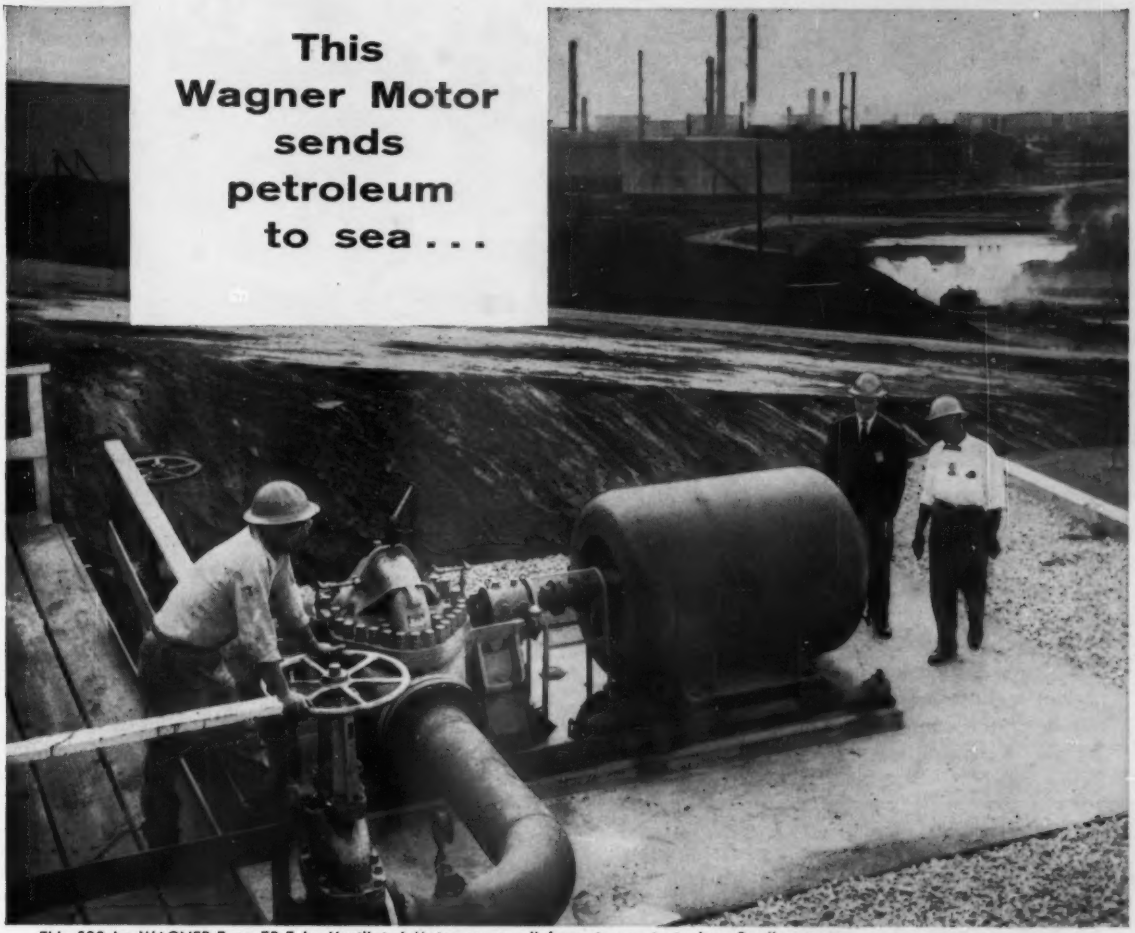
Construction is well under way on the expansion of a crude oil stabilization plant at Hassi Messaoud to increase output to 100,000 barrels of crude from the Sahara oil fields of the Compagnie Francaise des Petroles. Located 420 miles southwest of Algiers, initial components of the plant, designed and built by Stone & Webster, already are producing 54,000 barrels daily.

Design of the crude stabilization plant was based on process and economic studies by Stone & Webster engineers from the firm's London, Paris, and Boston offices. One of the unusual requirements was the effective removal of large quantities of wild gas from the well fluids. Separated gases presently are being flared, but they eventually will be processed to remove the liquefied petroleum gas, used in gas turbines for production of electric power, and returned to the wells for conservation.

Campus Car Park

Ground has been broken for the University of California at Los Angeles' first parking structure –

This Wagner Motor sends petroleum to sea . . .



This 500 hp WAGNER Type ZP Tube Ventilated Motor pumps oil from storage to tankers 2 miles away.

Big job, moving petroleum products to market. Standard Oil of California does it well . . . helped, at its El Segundo Refinery, by this 500 horsepower Wagner Tube Ventilated Motor. This explosion-proof motor's job: provide the power to pump crude oil from storage tanks down to the sea—and waiting tankers—two miles away.

Starting oil on a bon voyage is just one of many heavy-duty jobs performed by Wagner Tube Ventilated Motors. They also power big fans, blowers . . . any heavy-duty application that must be operated for long periods of time without a shut down.

These motors have fabricated steel frames that contain a series of tubes (as shown in photo below) through which cooling air is forced by an external blower. Internal blowers, one at each end of the rotor, circulate the warm air inside the motor through ducts in the rotor and stator and around cooling tubes. This effective cooling system holds the operating temperature of the motor within specified limits to lengthen motor life.

Whatever your motor requirements—large or small, for plant or product—Wagner can supply a standard motor or build a special motor to fit your needs. More than 65 years of constant research and development in electric motor design have made Wagner a name you can depend on. Call your nearby Wagner Sales Engineer for an analysis of your next motor application. There are Wagner branches in 32 principal cities.

WM60-11

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Wagner Electric Corporation

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SERVING 2 GREAT GROWTH INDUSTRIES—*ELECTRICAL • AUTOMOTIVE*

Campus car park is designed to blend with campus landscape at U.C.L.A. It will accommodate 891 cars.

a six-level, hillside unit which will accommodate 891 automobiles on a self park basis. Welton Becket & Associates, was the architect-engineer firm which designed and engineered the $884,000 parking facility. Designed to blend with the natural terrain of the campus, the structure will feature flat slab decks cantilevered outward from the supporting columns, giving the decks the appearance of floating in space. Massive retaining walls on two sides are designed to retain the hill and to provide air wells between the hill and the building to eliminate the need for air circulating equipment on those levels which would otherwise be underground.

Each of the six levels of the parking unit will have on-grade, individual entrances to eliminate vertical automobile circulation and entrance traffic congestion. Gates will be automatically controlled by the insertion of key cards into the electronic gate devices. Cantilevered stairways will provide for vertical pedestrian traffic.

Nigerian Harbor Project

The $10 million wharf extension program at Port Harcourt, principal seaport of Eastern Nigeria, is expected to be complete in 1960. It will provide berths for three additional ships, complete with transit sheds. In addition, a 500-yard wharf wall extension, new marshalling sidings, and a warehouse are under construction.

Constructed on a six-acre swamp, the new facilities will be built on fill laid over a fascine mattress. A new drainage system will discharge into the river through the wharf wall, from about three miles of drains.

The Port Harcourt project was designed for the Ministry of Transport, Federal Government of Nigeria, by the consulting engineer firm of Coode & Partners, Victoria Street, London.

Steam Drills Wells in Arctic

The Army has developed a method that uses steam to drill water wells in the Greenland ice cap. This new solution to the water supply problem will

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Grand Hotel
POINT CLEAR, ALABAMA

Here is a distinguished resort that is as popular for corporation board meetings as it is with honeymooners and vacationing families! Occupying all of historic Point Clear on Mobile Bay, Grand Hotel is internationally famous as a private pleasure-land for the discriminating.

In addition to superb cuisine and luxurious comfort in the intimate club atmosphere of a 350-acre estate, the hotel offers a championship golf course, a great pool with cabanas, deep-sea fishing cruisers and a long list of other facilities for fun outdoors. 100% air conditioned. American Plan.

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GRAND HOTEL — Point Clear, Alabama

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PUT ALL THESE FEATURES IN ONE HYDRANT AND YOU HAVE A

MATHEWS

A dry-head hydrant; adjustable nozzle levels; replaceable barrel—three of many major features that help make Mathews the one hydrant for sound community protection. The Mathews is designed to be always operable, always dependable, always ready to deliver at full pressure.

STOP NUT PREVENTS STEM FROM BUCKLING
The heavy bronze stop nut halts the downward travel of the stem just before the lower end touches the bottom of the elbow. This prevents any buckling stress on the stem when excessive pressure is put on the opening wrench.

AND ALL THESE OTHER FEATURES, TOO:
All working parts contained in replaceable barrel • Head can be faced in any direction • Replaceable head • Any nozzles you specify • Nozzle levels raised or lowered without excavating • Leakproof because stuffing box is cast integral with nozzle section • Operating thread only part requiring lubrication • Protection case of "Sand-Spun" cast iron for strength, toughness, elasticity • With bell, mechanical joint or flange pipe connections

Conform to latest AWWA specifications

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Manufacturers also of Mathews Flange Barrel Hydrants, R. D. Wood Hydrants, R. D. Wood Gate Valves, and "Sand-Spun" Pipe (centrifugally cast in sand molds)

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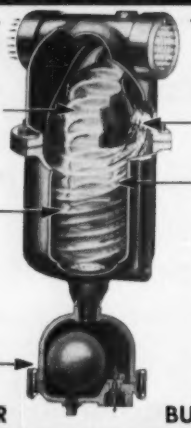
IMPROVED CYCLONE DESIGN
ASSURES MAXIMUM
ENTRAINMENT SEPARATION


IN-LINE INSTALLATION
SCREWED OR FLANGED ENDS
LARGE, HI LEVEL OUTLET CHAMBER NO REENTRAINMENT PROBLEM
HI SPEED ENTRY— MAX. CENTRIFUGAL ACTION
CLEAN DESIGN PRODUCES MIN. PRESSURE LOSS
ENTRAINMENT HUGS WALL FLOWS TO BOTTOM DRAIN
AVAILABLE IN SIZES TO 8" PRESSURES TO 1,000 P.S.I.
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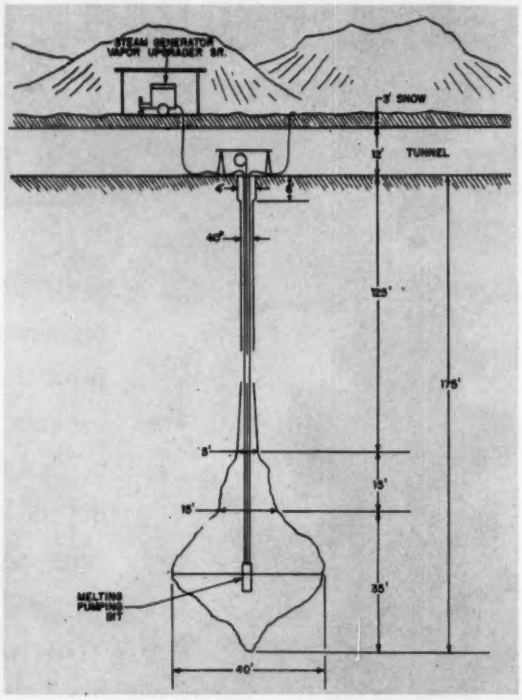
FEderal 3-3177
Thomas P. Ryan, mgr.

allow greatly expanded military operations in the subzero Arctic region.

Using a steam generator, a shaft of about 40 inches in diameter is drilled to a depth of 150



Steam generators will be used to drill wells at Arctic military installations for adequate water supply.

feet, or until a homogeneous ice structure is reached. The steam bit then is held stationary while it melts a bell shaped reservoir. A single well can supply water for 200 men, and also can be used for storage purposes when empty.

Los Angeles School Cost Cut

Almost $100,000 was saved on construction costs for Los Angeles' 112th Street School by the use of prestressed concrete lift slabs. Felix Kulka, structural engineer with T. Y. Lin and Associates, pointed out that design simplicity was the primary reason for the cost reduction.

The Lin firm designed two 72-ft by 143-ft roof slabs to be watertight, with no roofing membrane applied to the slabs. Roof slabs were an average of 8½-in. thick and designed to span typical bays of 32 feet by 28 feet. They were prestressed in both directions with Prescon cables.

Slabs were cast and prestressed on top of the grade slab before being lifted to their exact eleva-

JOB REPORT: *NELSON Stud Shear Connectors in Composite Construction*

COMPOSITE *STEEL-CONCRETE* CONSTRUCTION*

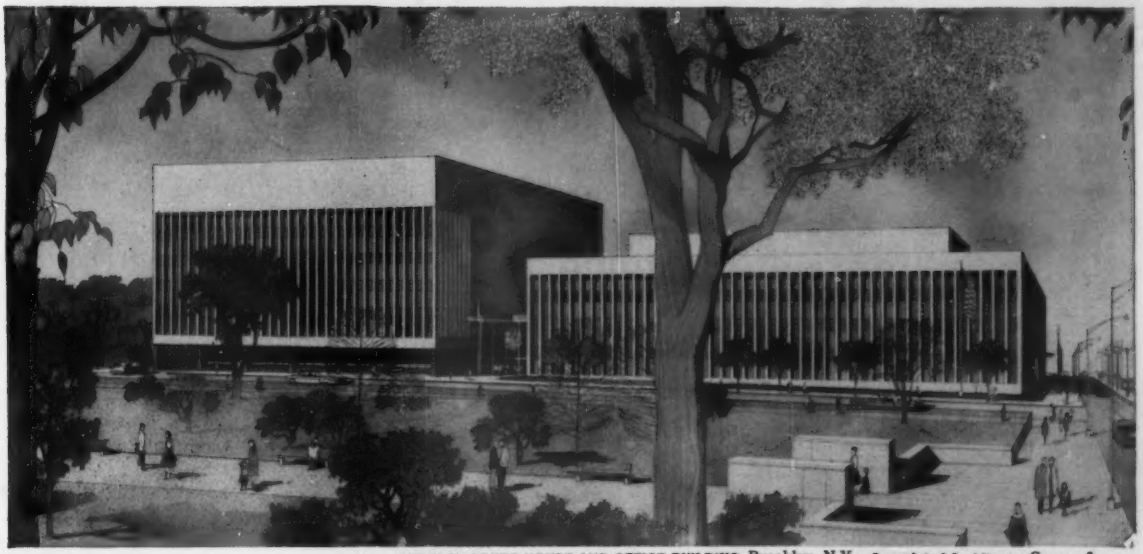
...in new Federal Court House

Composite construction will cut 20% to 25% from steel tonnage, according to structural engineering consultants Seelye Stevenson Value & Knecht. The project, now under construction, is the new court house and Federal office building in Brooklyn, N. Y.– the largest building ever to employ this modern design concept...

**A steel and concrete composite beam is made up of three essential elements: A steel beam, a reinforced concrete slab, and shear connectors. Horizontal shear is transferred to the beam through the shear devices which join the slab to the beam in such a way as to cause the concrete and steel elements to act as a unit.*

Although Composite Construction for buildings is relatively new (it has been used in bridge design for over three decades), many engineers and architects use it to gain these economies and advantages over non-composite construction... *shallower beams*—to meet equal load requirements • *reduced over-all cubage*—economies in materials • *longer spans*—greater load-carrying capacity per pound of steel • *wider spacing of columns*—more unobstructed floor space.

A *free* copy of the engineering story behind this Federal Court House project is now available. Call in your local Nelson Man, or write for "Record For Composite Construction", Nelson Stud Welding, Division of Gregory Industries, Inc., Dept. 14, Lorain, Ohio.



FEDERAL COURT HOUSE AND OFFICE BUILDING, Brooklyn, N.Y.—**Associated Architects:** Carson & Lundin, Lorimer & Associates • **Structural Engineers:** Seelye Stevenson Value & Knecht • **General Contractors:** P. J. Carlin Construction Co. and Atlas Tile & Marble Works • **Shear Connector Applicator Contractor:** W. R. Johnson, Jr., Associates, Inc.

NELSON Stud Shear Connectors *are approved by the AASHO for bridge construction.*

NELSON STUD WELDING

DIVISION OF GREGORY INDUSTRIES, INC.

Manufacturers of... NELSON STUD WELDING PRODUCTS • NELSON BULLDOG CONCRETE FASTENING PRODUCTS • NELSON POWDER-ACTUATED FASTENING TOOLS

tion. They were attached to the precast concrete columns by bars slipped through the columns. Success on this project may result in the construction of three similar buildings by the Los Angeles Board of Education, Structural engineer on the 112th Street project was Johnson and Nielson of Los Angeles; architect Hagman and Meyer.

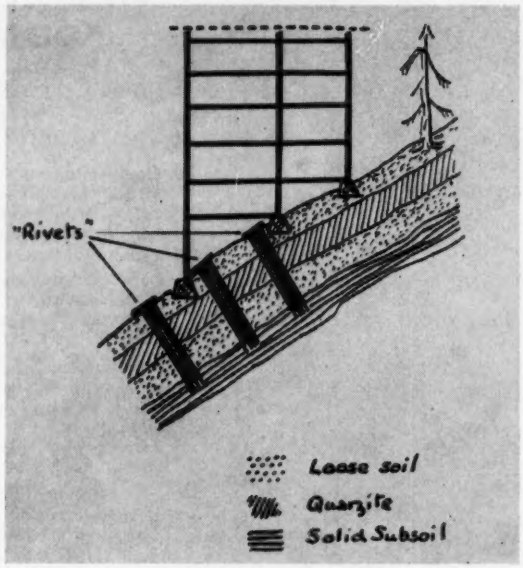
Helicopter on Line Construction

Both pole setting and line stringing was accomplished by helicopter on a recent powerline relocation project for the Bureau of Reclamation. Line Builders, Inc., of Billings, Montana, employed a Hiller helicopter for lifting 1100 pound poles, and even heavier reels of wire, on a winter project west of Cody, Wyoming.

A Building at Anchor

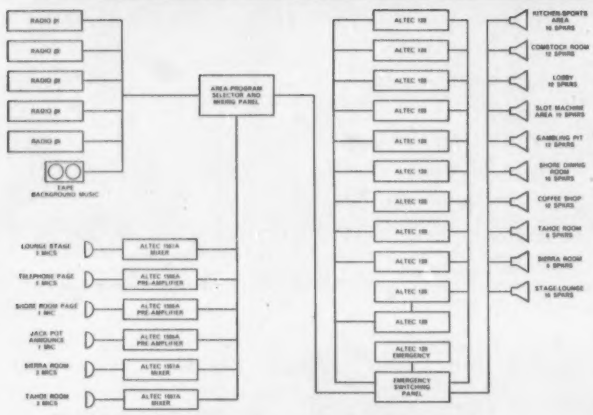
With the fifth floor completed, a proposed eight-story building, located in Westphalia, West Germany, started to slide down its mountainside location. The 174-ft by 44-ft structure rested on a layer of loose ground that failed under its weight and began to settle along a layer of hard quartzite.

In a desperate attempt to save the building, a heavy rock drill was rushed to the site and about 150 holes, 20-ft deep, were drilled through the basement floor to solid subsoil below the layer of quartzite. Iron bars, 1¾-inches in diameter, were grouted in place and linked in sets of four with reinforced concrete beams. ▲▲



Grouted-in-place iron bars kept this eight story building from sliding down its mountainside site.

Reno's Holiday Hotel Sound Contractors* *specified* ALTEC



Wherever they go, from casino to sports area, guests at Reno's luxurious Holiday Hotel, enjoy the matchless sound of a complete paging and music system which employs over 130 ALTEC sound components. And you'll find ALTEC-engineered sound systems in hundreds of other fine commercial and civic buildings, hospitals, churches and shopping centers everywhere. For ALTEC sound components are quality-engineered for pure reproduction, dependable service under all conditions, ease of installation and service. Hundreds of ALTEC engineer-consultant contractors are ready to assist you by supplying over 100 different components or designing a complete system to your specifications. Find your nearest ALTEC engineer in phone directory yellow pages or write ALTEC, Dept. CE-6D at either address below.

See our catalog in Sweet's Architectural File 34/AL; Industrial Construction File 17e/AL, 1960 Edition

* Dayco Electronics, Inc., San Francisco

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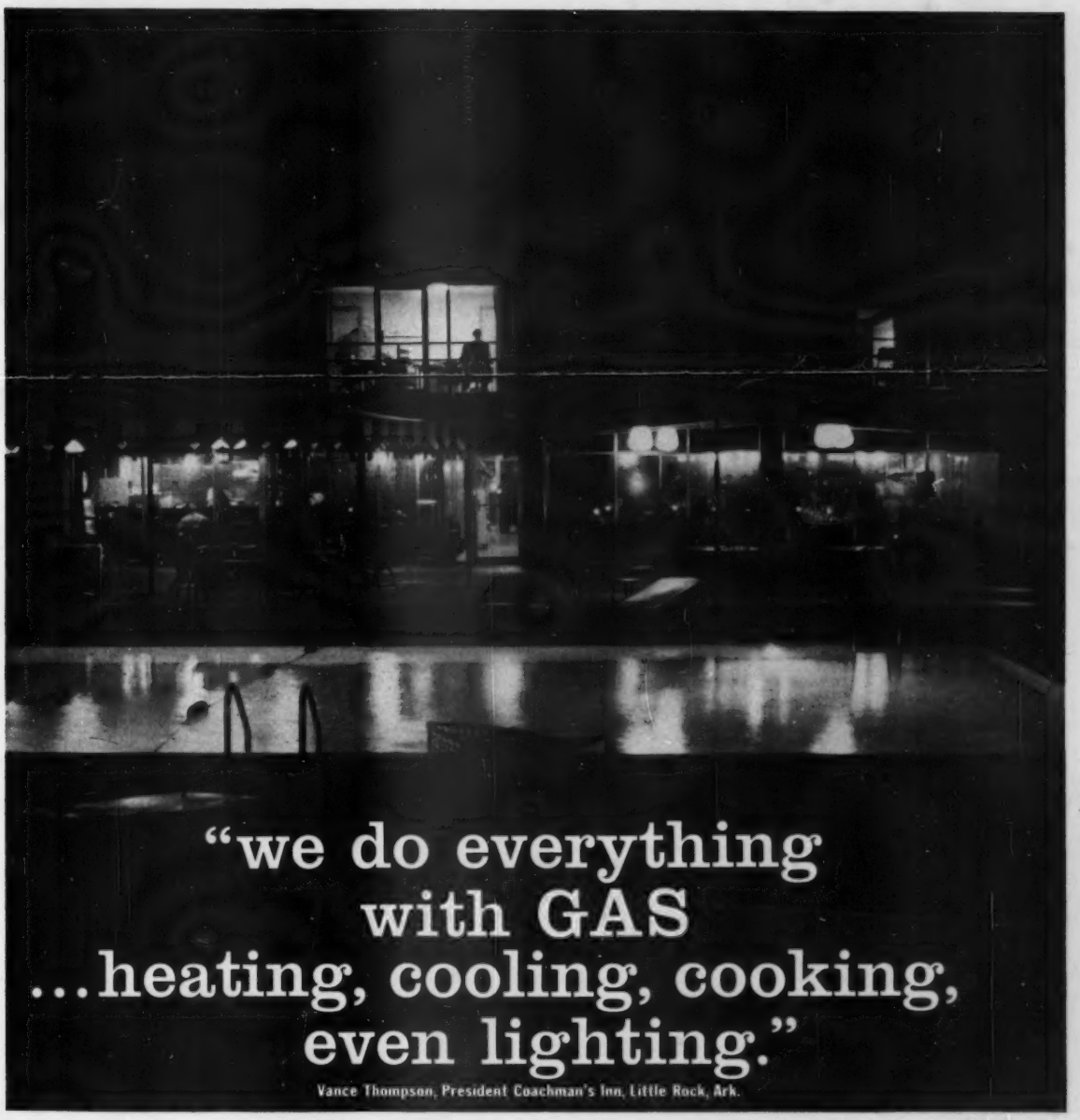

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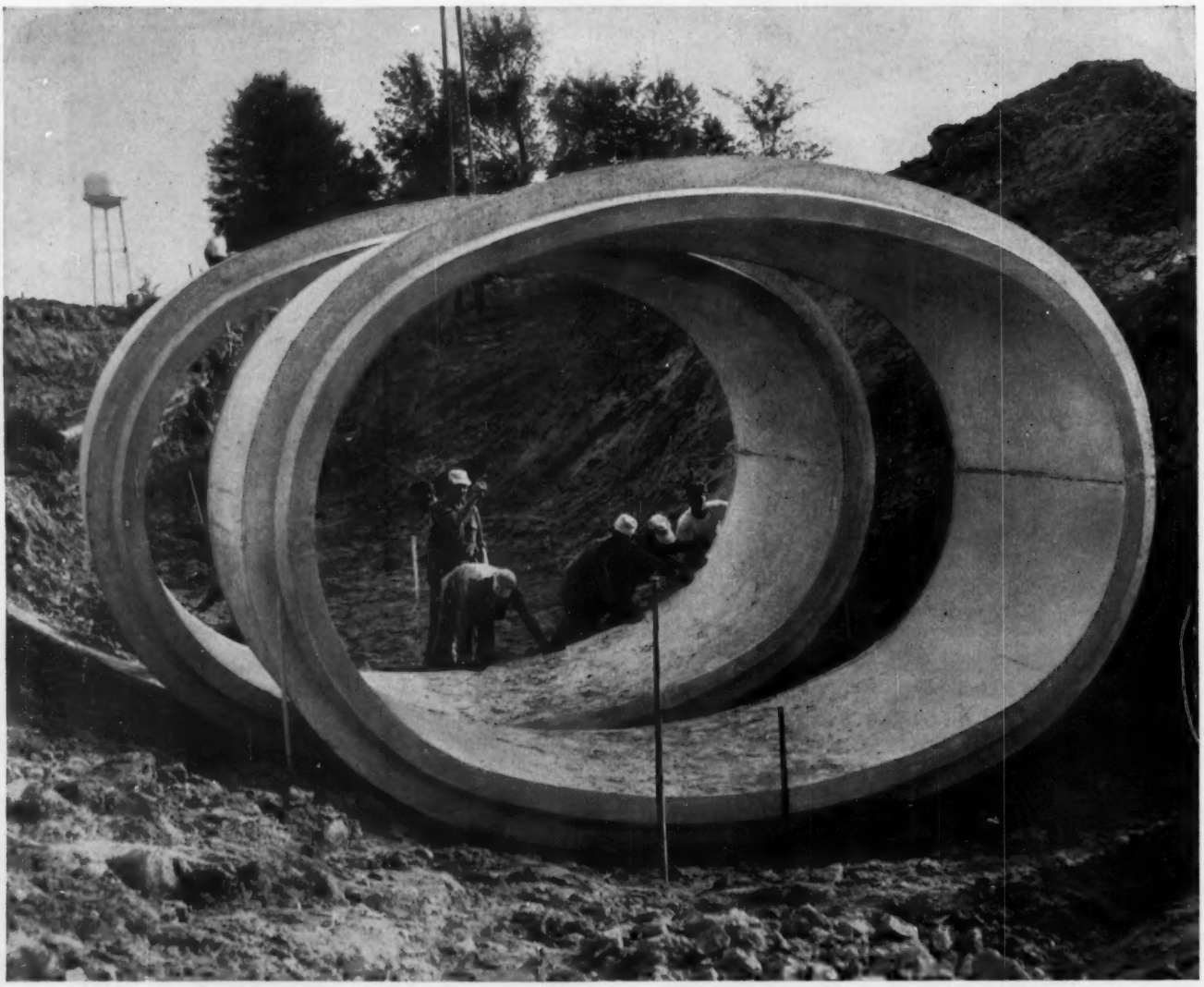
USS American Welded Wire Fabric selected to



This is a 6-foot section of 144" elliptical concrete pipe. It has a greater flow capacity than its equivalent in round pipe and it can be installed in a minimum depth of cut with increased depth of cover. Elliptical pipe saves headroom—allows sufficient cover to reduce frost heave.

Lamar Pipe & Tile Division, American-Marietta Company, Grand Rapids—Pipe Manufacturer

L. W. Edison Company, Grand Rapids, Michigan—Contractor

USS American Welded Wire Fabric conforms perfectly to the elliptical shape of the 144″ pipe. Because of the machine prefabricated accuracy of USS American Welded Wire Fabric, cages can be formed faster, and the spacing and concentricity of cages can be accurately controlled.

strengthen concrete pipe on Michigan Highway job

The Michigan State Highway Engineers faced a problem when it came to the selection of pipe for an important new highway in Berrien County. Hydraulic and grade line considerations dictated pipe with maximum water-carrying capacity with a low flow line, but with up to 33 feet of back fill. They selected over 1,000 linear feet of elliptical, reinforced concrete pipe. Diameters varied from the smallest to the largest—18″ to 144″.* Lamar Pipe & Tile Division, American-Marietta Company, manufactured the pipe.

In the case of the 480 feet of 144″ required to withstand 33 feet of backfill, the specifications required 3 lines of reinforcement—an inner and outer cage each having 0.754 square inches per foot, and an elliptical cage having an area of 1.508 square inches per foot. Lamar Pipe & Tile elected to use American Welded Wire Fabric on this big job.

Concrete pipe manufacturers insist on quality reinforcing, meeting rigid specifications—that's why so many of them use USS American Welded Wire Fabric. This quality product—with its machine-made accuracy, assures the proper distribution of steel because the wire diameters are held to the close tolerance of ±0.003″ and their spacing may not vary by more than ¼″ center-to-center. This prefabricated product is more accurate than other forms of reinforcing. Its cold-drawn, high-tensile steel wires have a minimum yield point of 60,000 psi and a minimum ultimate strength of 75,000 psi. For more information, write to American Steel & Wire, 614 Superior Avenue, N.W., Cleveland 13, Ohio.

*Round equivalent

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To increase the strength of the pipe, by resisting diagonal tension, 320 ⅜″ diameter stirrups are attached through the three cages of USS American Welded Wire Fabric.

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Consulting Engineers' Calendar

June 1-2. Marquette University; Institute — "Recent Advances in Solid State Devices," Campus, Milwaukee, Wisconsin.

June 1-2. West Virginia University; 1960 Appalachian Underground Short Course, Morgantown, Virginia.

June 2-3. The University of Wisconsin; Engineering Institute on Consulting Engineers' Problems, Wisconsin Center Building, Campus.

June 5-10. American Society of Mechanical Engineers; Semiannual Meeting and Aviation Conference, Statler Hilton, Dallas, Texas.

June 8-11. National Society of Professional Engineers; Annual Meeting, Statler Hotel, Boston, Massachusetts.

June 13-15. American Society of Heating, Refrigerating and Air-Conditioning Engineers; Annual Meeting, Royal York Hotel; Vancouver, B.C., Canada.

June 13-17. American Society of Civil Engineers; Conference on Shear Strength of Cohesive Soils, University of Colorado, Boulder, Colorado.

June 19-22. American Institute of Chemical Engineers; General Meeting, Del Prado, Mexico City, Mexico.

June 20-22. American Society of Mechanical Engineers; Applied Mechanics Conference, Pennsylvania State University, University Park, Pa.

June 20-24. American Institute of Electrical Engineers; Summer General Meeting, Atlantic City, N. J.

June 20-24. American Society of Civil Engineers; Convention, Reno, Nevada.

June 20-25. United States Committee on Large Dams, Reno, Nevada.

July 6-8. American Society of Civil Engineers, American Society for Engineering Education; Cooper-Union, co-sponsors; Conference on Civil Engineering Education, University of Michigan, Ann Arbor, Michigan.

July 10-22. Pennsylvania State University; Seminar on Atomic Shelters (architectural and engineering planning aspects, Campus.

Aug. 15-17. American Society of Mechanical Engineers and American Society of Chemical Engineers; Heat Conference and Exhibit, Statler Hilton, Buffalo, New York.

Aug. 17-19. American Society of Civil Engineers; Hydraulics Conference, University of Washington, Seattle, Washington.

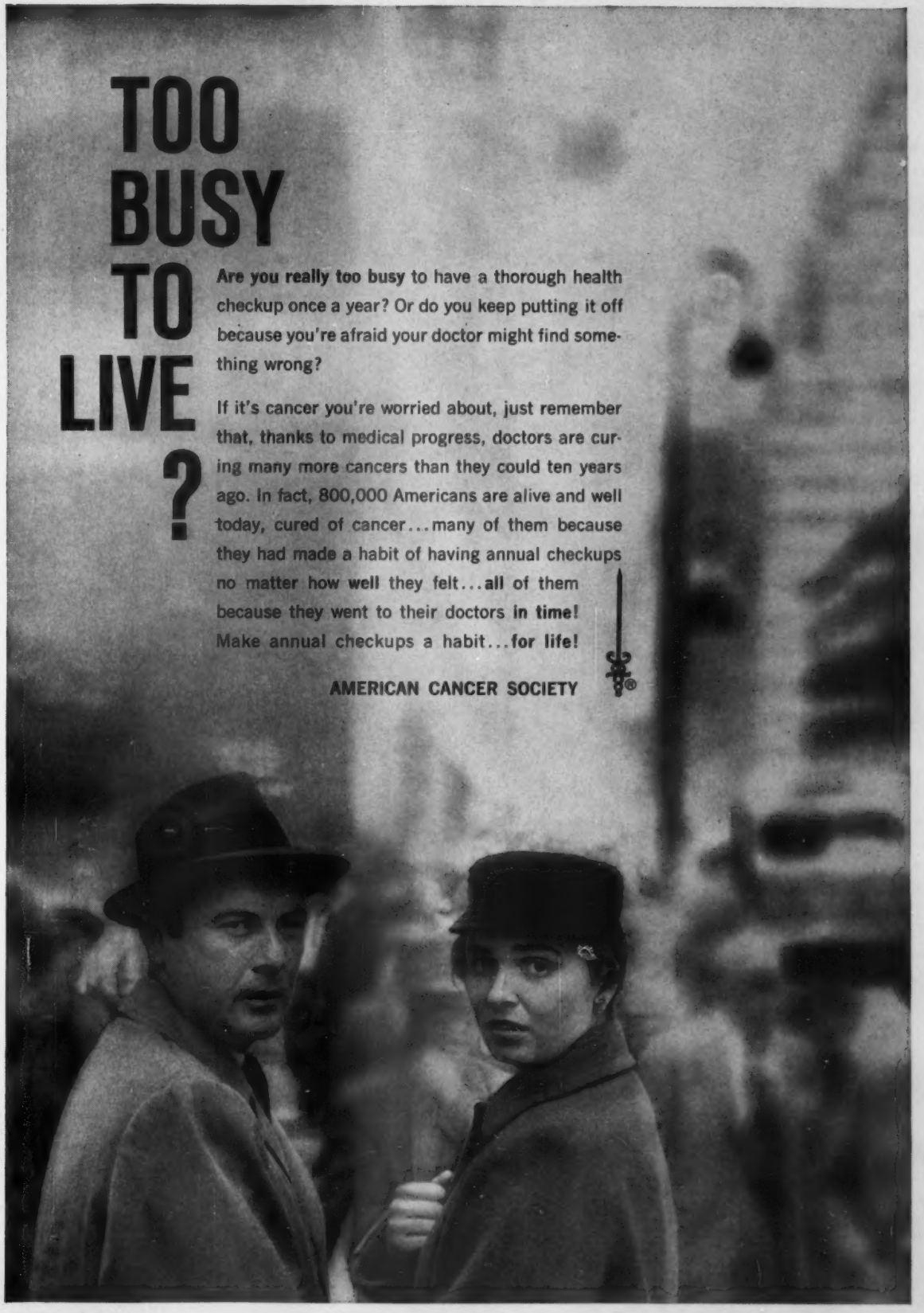
Sept. 8-9. American Society of Civil Engineers; Conference on Electronic Computation, Hilton Hotel, Pittsburgh, Pennsylvania.

Sept. 15-16. American Society of Mechanical Engineers; Engineering Management Conference, Hotel Morrison, Chicago, Illinois.

Sept. 25-28. American Institute of Chemical Engineers; National Meeting, Hotel Mayo, Tulsa, Oklahoma.

Sept. 26-30. Instrument Society of America; Fall Instrument-Automation Conference & Exhibit, Annual Meeting, Coliseum, New York, N. Y.

Sept. 27-30. Prestressed Concrete Institute; 6th Annual Convention, Statler-Hilton, New York, N. Y.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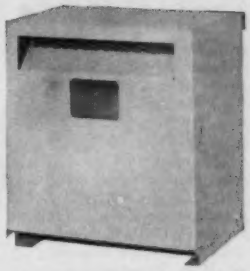

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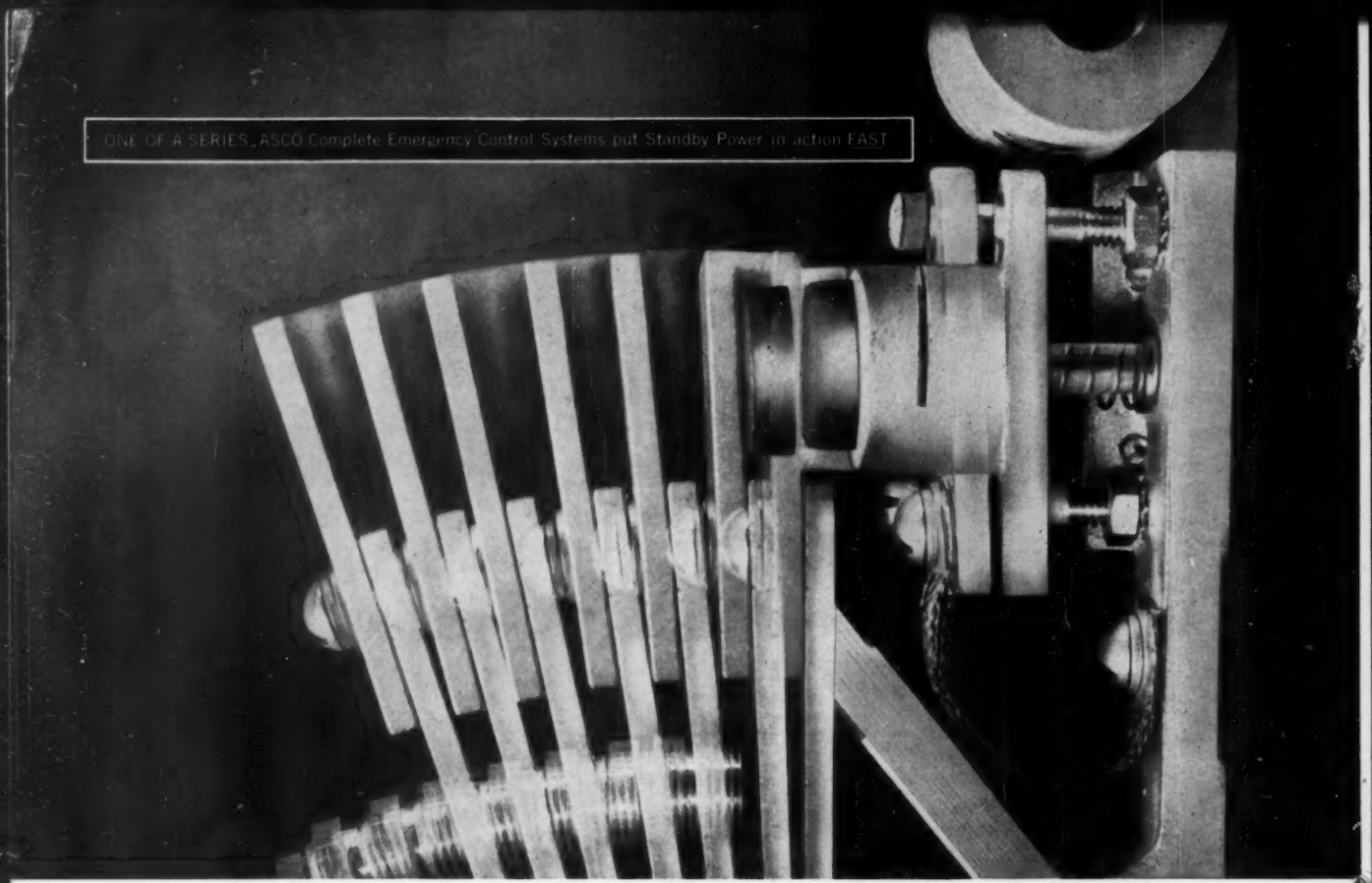

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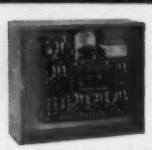

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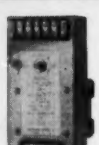

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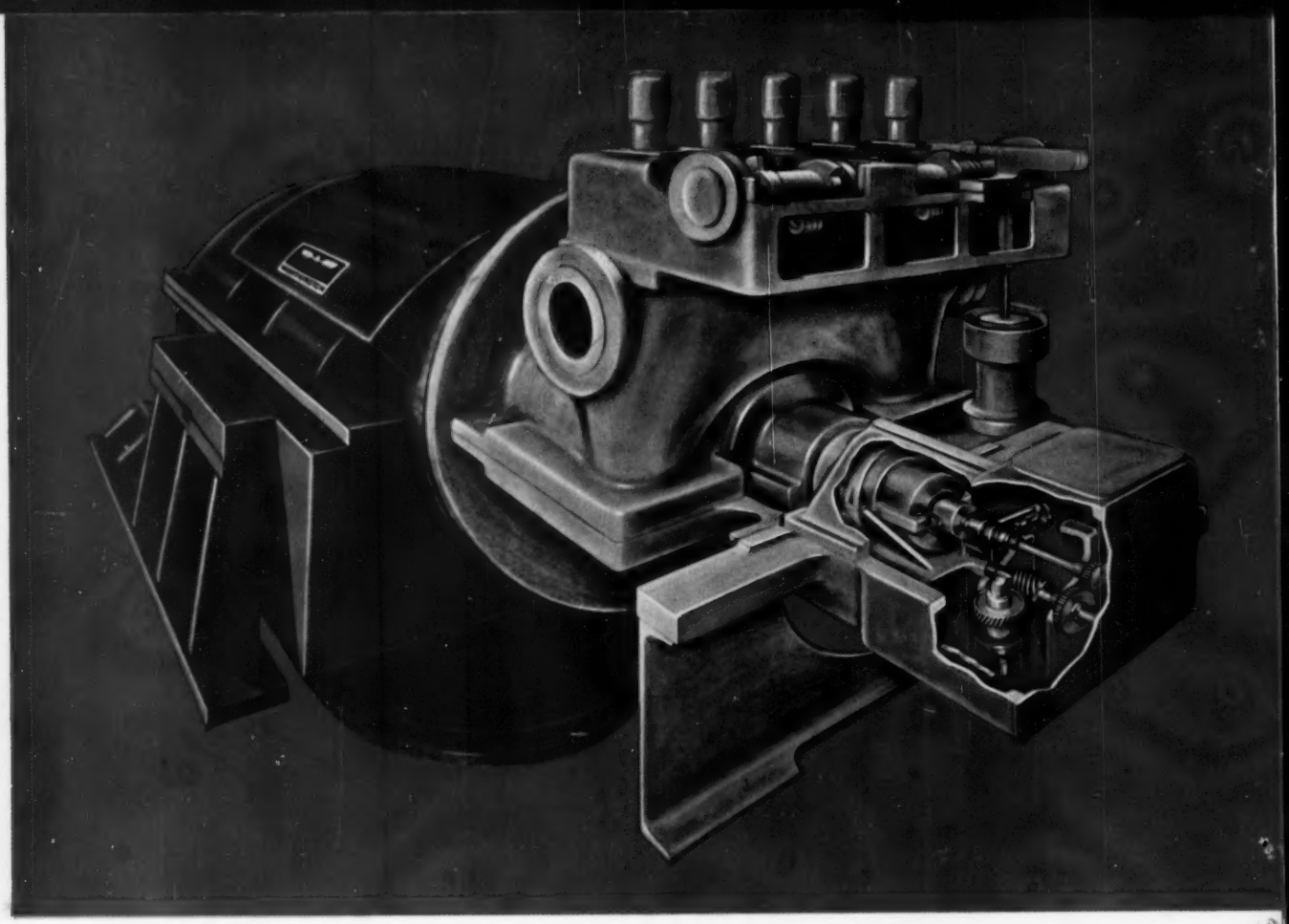
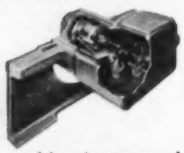
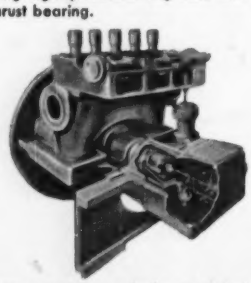


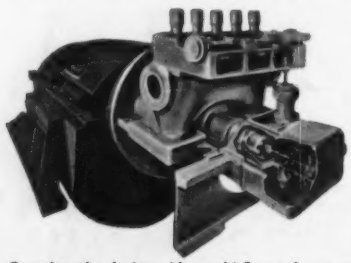
HOW WE ASSURE RELIABILITY IN A NEW DESIGN



1. Use an existing high-speed bearing case and a high capacity thrust bearing.



2. Add a high-pressure steam end of proved design with cam operated automatic nozzle control valves.



3. Complete the design with a multi-flow exhaust end.

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